Extron Electronics
INTERFACING, SWITCHING AND DISTRIBUTION

User's Manual

Matrix 200 Switcher

Extron's Warranty

Extron Electronics warrants the product against defects in materials for a period of two years and defect in workmanship for a period of two years from the date of purchase. In the event of malfunction during the warranty period attributable directly to faulty workmanship and/or materials, Extron Electronics will, at its option, repair or replace said products or components, to whatever extent it shall deem necessary to restore said product to proper operating condition, provided that it is returned within the warranty period, with proof of purchase and description of malfunction to:

Extron Electronics
1230 South Lewis Street
Anaheim, CA 92805, U.S.A.

This Limited Warranty does not apply if the fault has been caused by misuse, improper handling care, electrical or mechanical abuse, abnormal operating conditions or non-Extron authorized modification to the product.

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Units must be returned insured, with shipping charges prepaid.
If not insured, you assume the risk of loss or damage during shipment.
Returned units must include the serial number and a description of the problem, as well as the name of the person to contact in case there are any questions.

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EXTRON ELECTRONICS / RGB SYSTEMS, INC.
1230 South Lewis Street, Anaheim, CA 92805
(800) 633-9876 (714) 491-1500 FAX (714) 491-1517
U.S.A.

EXTRON ELECTRONICS, EUROPE
Beeldschermweg 6C, 3821 AH Amersfoort
+31-33-453-4040 FAX +31-33-453-4050
The Netherlands

EXTRON ELECTRONICS, ASIA
41B Kreta Ayer Road, Singapore 089003
+65-226-0015 FAX +65-226-0019
Singapore

Chapter 1 - Introduction to the Matrix 200

Chapter 2 - Hardware Installation

Chapter 3 - Rear Panel Connections

Chapter 4 - Using the Front Panel Controller

Chapter 5 - Windows® Software Control

Appendix A - Part Numbers, Glossary and Troubleshooting

Appendix B - Programming Guide

Legend of Icons

The following icons may be used in this manual:

_____ *Important information – for example, an action or a step that must be done before proceeding.*

_____ *A Warning – possible dangerous voltage present.*

_____ *A Warning – possible damage could occur.*

_____ *A Note, a Hint, or a Tip that may be helpful.*

_____ *Possible Electrostatic Discharge (ESD) damage could result from touching electronic components.*

_____ *Indicates word definitions. Additional information may be referenced in another section, or in another document.*

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Rev. C1, 79-03, new format
Rev. D, 79-08

Written and printed in the USA

Matrix 200
User's Manual

Chapter One

Introduction to the Matrix 200

I/O Modules

Configurations

Standard Features

Optional Features

Matrix 200 Module Specifications

General

Each Extron Matrix 200 is custom designed to the user's specifications. The configuration is built from various combinations of ten I/O modules. The I/O modules and possible configurations are listed below. The Matrix 200 can be controlled from a host computer, a Front Panel Controller (FPC), or a QuickSwitch™ Front Panel Controller (QS-FPC).

Matrix units can also be interconnected to expand the switching capabilities for up to 48 inputs by 48 outputs. This allows for multiple switching combinations.

I/O Modules

Matrix 200 Switchers are ordered for a specific application with a combination of I/O modules. Each module switches one type of video signal – one for red, one for blue, etc. One audio module switches both left and right stereo channels.

- *4 x 4 High-Resolution Analog Module (HRAM), with 250 MHz video bandwidth*
- *8 x 4 High-Resolution Analog Module (HRAM), with 250 MHz video bandwidth*
- *8 x 8 High-Resolution Analog Module (HRAM), with 250 MHz video bandwidth*
- *4 x 4 Sync Module*
- *8 x 4 Sync Module*
- *8 x 8 Sync Module*
- *4 x 4 Video Module*
- *8 x 4 Video Module*
- *8 x 8 Video Module*
- *8 x 8 Stereo Audio Module*

For example: a Matrix 200 designed to switch RGB, separate horizontal and vertical sync, and stereo audio, will require the following modules: three HRAM, two Sync and one audio modules.

Configurations

Depending upon the configuration of I/O modules (above), the Matrix 200 Switcher can have up to 16 different input/output configurations. The configuration determines how many modules are required.

- *RGsB* — *Red, Green, (sync on green), Blue*
- *RGBS* — *Red, Green, Blue and separate composite Sync*
- *RGBHV* — *Red, Green, Blue and separate H&V Sync*
- *RGsBCv* — *Red, Green, (sync on green), Blue, and Composite video*
- *RGsBYC* — *Red, Green, (sync on green), Blue and S-Video*
- *RGBSCv* — *Red, Green, Blue, composite Sync, and Composite video*
- *RGsBA* — *Red, Green, (sync on green), Blue, and stereo Audio*
- *RGBSA* — *Red, Green, Blue, Sync, and stereo Audio*
- *RGBHVA* — *Red, Green, Blue, separate H&V sync, and stereo Audio*
- *RGsBCvA* — *Red, Green, (sync on green), Blue, Composite video, & stereo Audio*
- *RGsBYCA* — *Red, Green, (sync on green), Blue, S-Video, & stereo Audio*
- *RGBSCvA* — *Red, Green, Blue, composite Sync, Composite video, & stereo Audio*
- *CvA* — *Composite video, and stereo Audio*
- *YCA* — *S-Video with stereo Audio*
- *Cv* — *Composite video*
- *YC* — *S-Video*

Standard Features

- *Microprocessor control, with battery backup*
- *RS-232/RS-422 control*
- *Complete breakaway*
- *Composite and S-Video Genlock*
- *RGB video delay switching*
- *Separate video and audio mute*
- *Security Lockout*
- *250 MHz bandwidth*

Microprocessor Control — The Matrix 200 is programmable from a host system, or from the optional Front Panel Controller. It uses memory to store configurations and a calendar/clock to activate these preset configurations at a specific date and time. The battery backup prevents loss of preset information.

RS-232/RS-422 Control — The Matrix 200 can be controlled by any remote control system or computer with RS-232/RS-422 serial communications capability. Refer to Appendix B for programming guidelines including a complete listing of RS-232/RS-422 communications protocol.

Complete Breakaway — The complete breakaway feature of the Matrix 200 allows the user to program any Video, S-Video or Audio Channel to be controlled separately (breakaway) or as a group (follow one or more inputs, or all RGB inputs). A fully populated RGBS composite video and audio switcher can be controlled as three separate switchers.

Complete breakaway allows individual video or audio outputs to follow any one or more RGBS inputs when switched to an output channel. This makes the Matrix 200 capable of adding audio to any or all RGBS or video channels, as well as allowing switchable video and audio to follow any switched RGBS channel.

Video Genlock — The Matrix 200 features a broadcast quality NTSC/PAL/SECAM Composite Video or S-Video Genlock for synchronized switching of signals. The Matrix 200 will Genlock as many composite video signals as are installed in the switcher.

RGB Delay Switching — The Matrix 200 can be programmed to delay switching the RGB video for 1 to 9 seconds after the sync is switched. This allows the display device to be in sync before the picture arrives, providing seamless switching of the RGBS signals when switching between various frequencies.

Video and Audio Mute — The Matrix 200 provides separate mute controls to easily mute (turn off) the RGBS or audio signals. Mute can be programmed to operate independently on different outputs, or all outputs can be muted simultaneously with a single button.

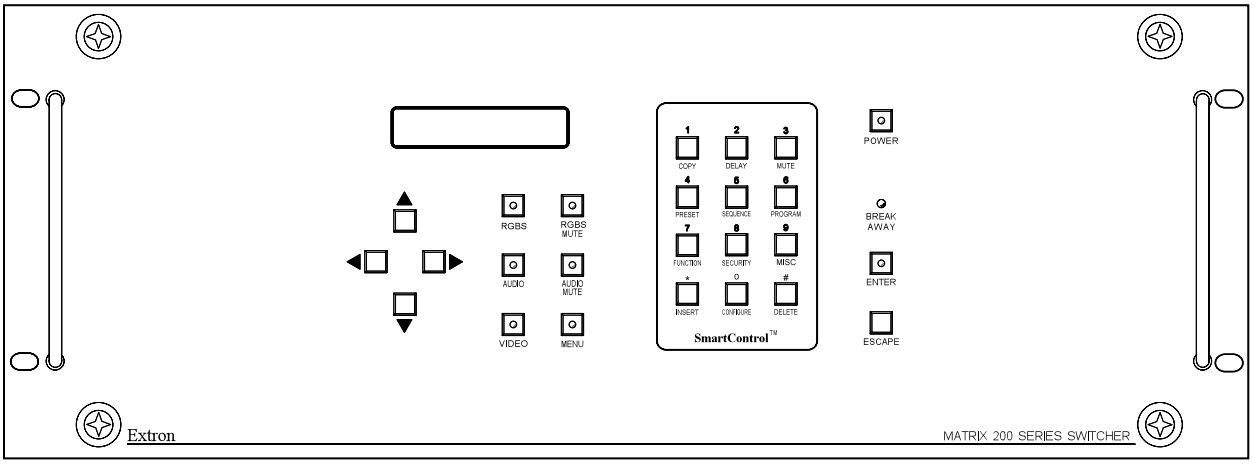
Security Lockout — Matrix 200 programs can be protected by denying access through the RS-232 port, as well as through the Front Panel. Access is allowed only with a security passcode.

Executive Mode — The Matrix 200 front panel buttons can be enabled/disabled to restrict Matrix 200 configuration changes.

250 MHz Bandwidth — Even when fully populated, the Matrix 200 has a bandwidth of no less than 250 MHz (-3 dB).

Optional Features

- *Front Panel Controller (FPC)*
- *SmartControl™ microprocessor*
- *QuickSwitch™ Front Panel Controller (QS-FPC)*
- *Redundant power supply*



Front Panel Controller (FPC)

The Front Panel Controller (FPC) provides local control of all Matrix 200 Switcher functions. It is supplied as an optional accessory to the Matrix 200 and is intended for users who wish to supplement normal RS-232/RS-422 computer control with local or remote operator control. For even greater flexibility, two FPCs can be connected to the same Matrix 200 - one mounted to the front of the Matrix 200 and the other located remotely. Refer to Chapter 2 for instructions on mounting the FPC, and to Chapter 4 for FPC operation. The FPC includes the following features:

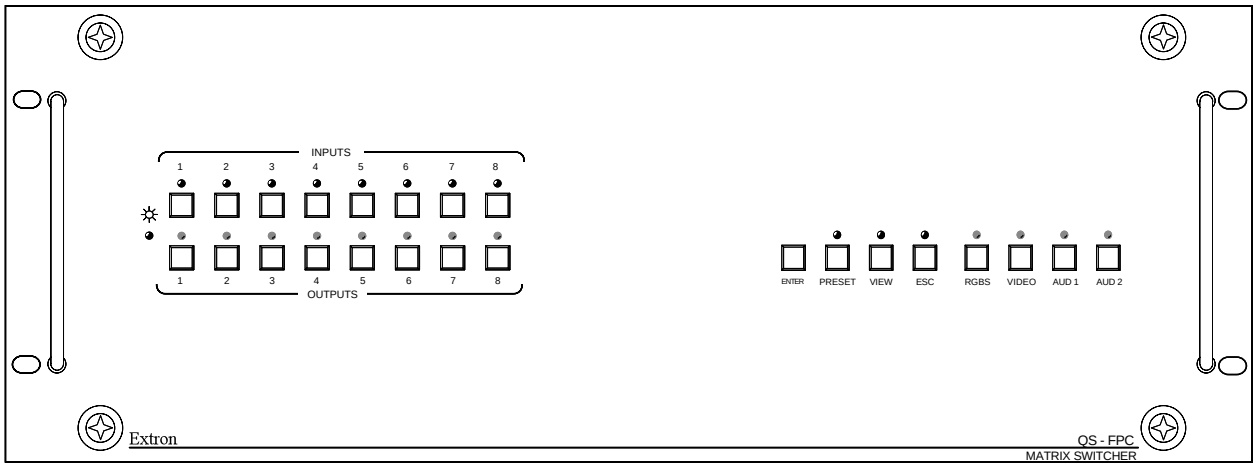
Control Microprocessor — "SmartControl™" is the Front Panel's built-in microprocessor. It determines the Matrix 200 input/output configuration, what presets are saved, as well as all other switcher settings. SmartControl effectively configures the Matrix 200.

Trouble Status Indication — The SmartControl microprocessor continuously monitors Matrix status, and also alerts the user to any problems that may have occurred, such as: loss of power (if the Matrix 200 has the optional redundant power supply) or loss of front panel control when using the optional FPC. This helps isolate any equipment malfunction quickly.

Configuration Memory — SmartControl can store up to 20 different connection configurations (called presets). This can save hours of reprogramming each I/O configuration. The Front Panel Controller (FPC) allows for easy configuration of inputs and outputs, as well as the control of additional system features.

Two separate FPCs can be used to control one Matrix 200 switcher. For example, a second FPC could be used to control the switcher from as far away as 200 feet. When controlling the switcher via RS-232/RS-422, the FPC may or may not be needed.

LCD Menu-driven SmartControl — The Front Panel includes a lighted, liquid crystal display (LCD) that is used to step through the setup and program functions necessary to install and operate the Matrix 200. A full complement of function buttons makes setup and programming of the unit fast and easy.



QuickSwitch™ Front Panel Controller (QS-FPC)

The QuickSwitch Front Panel Controller (QS-FPC) provides local control of all Matrix 200 Switcher functions. It is supplied as an optional accessory to the Matrix 200 and is intended for users who wish to supplement normal RS-232 computer control with local or remote operator control. Refer to Chapter 2 for instructions on mounting the QS-FPC, and to Chapter 4 for QS-FPC operation. The QS-FPC includes the following features:

Control Microprocessor SmartControl™ is the Front Panel's built-in microprocessor. With it, the user determines the Matrix 200 input/output configuration, what presets are saved, as well as all other switcher settings.

Configuration Memory SmartControl can store up to eight different matrix configurations (called presets). This can save hours of reprogramming each I/O configuration. The QuickSwitch Front Panel Controller (QS-FPC) allows for easy configuration of inputs and outputs, as well as the control of additional system features.

QuickSwitch SmartControl The Front Panel's full complement of function buttons makes setup and programming of the unit fast and easy.

Redundant Power Supply

The Matrix 200 can be ordered with an optional redundant (backup) power supply to prevent signal loss if input power to the primary power supply should suddenly be lost or interrupted.

Sample Configuration

The picture here shows one example of the I/O modules that could be installed in six planes of a Matrix 200. See page 1-1 for I/O modules and possible configurations.

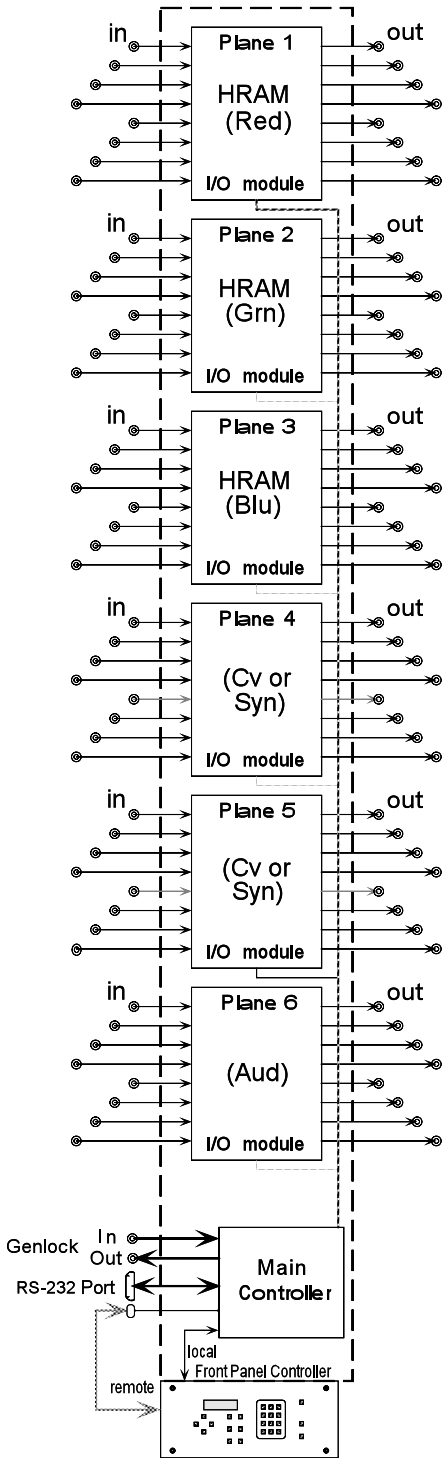
For example, an 8 x 8 RGBS switcher requires: three 8 x 8 high-resolution analog modules (HRAM) and one 8 x 8 sync module (Syn). This would occupy the Red, Green, Blue and one Sync/Video planes. The fifth plane could have a composite video module (Cv), and the sixth plane could have an audio switching module (Aud).

This configuration is capable of being controlled and routed as three separate switchers:

- *one 8 x 8 RGBS matrix switcher*
- *one 8 x 8 video switcher*
- *one 8 x 8 audio switcher*

In addition, SmartControl™ allows the Matrix 200 to group these functions as a single RGBS composite video switcher with stereo audio.

The bottom of the diagram illustrates how the Main Controller (and the optional Front Panel Controller) routes the various inputs to the outputs.



Matrix 200 I/O Module Specifications

Power	100 - 240 VAC, 50/60 Hz, 60 Watts
Dimensions	17" W, 15" D, 6.8" H
	43 cm W, 38 cm D, 17 cm H
Shipping Weight	22 lbs (10 kg)
Operating Temperature	0° C - 50° C
Storage Temperature	-20°C - 70° C
MTBF	35,000 Hours (demonstrated)
Approved	CE, UL, CUL Listed
Warranty	2 years, parts and labor

HRAM Video (High Resolution Analog Module)

Connectors	BNC
Bandwidth	250 MHz (-3 dB)
Crosstalk:	
at 10 MHz	-50 dB(typical) See note 1.
at 100 MHz	-30 dB
at 200 MHz	-30 dB
Isolation:	
at 10 MHz	-60 dB (typical) See note 2.
at 100 MHz	-55dB
Return Loss:	
at 10 MHz	-20 dB
at 200 MHz	-50 dB
Input Impedance	75 ohms
Output Impedance	75 ohms
Switching Speed	200 ns (nominal)
Input Signal	0.3-1.0 V p-p (max dc offset ± 0.30 V)
Gain	Unity ±1%

Note 1: Crosstalk is the attenuation of all hostile signals relative to a given input-output connection.

Note 2: Isolation is the attenuation of an input signal relative to an unselected output when all inputs have the same signal applied simultaneously.

Composite Video Module

Frequency Response	-0.5 dB @ 5 MHz; -3.0 dB @ 15 MHz
Differential Gain	0.5%
Differential Phase	1.3°
Line and Field Tilt	Less than 0.1%
Isolation Between Outputs	Greater than 40 dB @ 5 MHz
Crosstalk	Greater than 40 dB @ 5 MHz
CMRR	-60 dB
Propagation Delay	10 ns
Input Signal	75 ohms, analog, 0-1.0 V p-p
	(max dc offset ±0.30 V)
Gain	Unity

Sync Module

Input Impedance	510 ohms
Output Impedance	75 ohms
Max. Input Voltage	±5 V
Input Sensitivity	500 mV p-p
Output Level	4.5 V p-p not terminated;
	2.2 V p-p terminated at 75 ohms
Max. Propagation Delay	64 ns H to L (41 ns L to H)
Max. Rise/Fall Time	8 ns H to L (3.6 ns H to L)
Polarity	Follows input

Audio Module, General

Input Impedance	High Z (>10k ohms, typical)
Input Voltage Level	To 6 V p-p into 600 ohms
Output Impedance	Low, capable of driving 600 ohms, balanced
Output Level	Near zero to unity gain
Connectors	6-conductor, Phoenix® Captive Screw Terminal
Signal to noise	Better than 110 dB, 20Hz-20kHz
Total Harmonic Distortion + Noise	Worst case 0.03% @ 20kHz, 30 V p-p (Differential Output)
Adjacent Channel Crosstalk	Better than -85 dB @ 20kHz
Common Mode Rejection Ratio	-55 dB worst case @ 20kHz (-65 dB Typical)
Stereo Channel Separation	Greater than 60 dB 20 Hz - 20kHz
Bandwidth	20Hz - 20kHz, Flat ± 0.1 dB

Audio Input Specifications

Professional Mode Attenuation	20 dB
Consumer Mode Attenuation	0 dB
Maximum Input Level:	
Professional Mode	60 V p-p Differential; 60 V p-p Single-ended
Consumer Mode	6 V p-p Differential; 6 V p-p Single-ended
Nominal Input Program Level:	
Professional Mode	+4 dBu (1.2 V rms)
Consumer Mode	-10 dBu (300 mV rms)
User Controllable Input Gain	+31.5 dB Gain -95.5 dB Attenuation (In 1 dB steps, using FPC; in 0.5 dB steps, using Serial interface)
Input Impedance	10 k ohms, Differential to Ground

Audio Output Specifications

Professional Mode Gain	14 dB
Consumer Mode Gain	0 dB
Maximum Output Level:	
Professional Mode	60 V p-p Differential; 30 V p-p Single-ended
Consumer Mode	12 V p-p Differential; 6 V p-p Single-ended
Nominal Output Program Level:	
Professional Mode	+4 dBu (1.2 V rms)
Consumer Mode	-10 dBu (300 mV rms)
Stereo Channel Directing:	Left Input to Left & Right Output Right Input to Left & Right Output
Channel swap	Right Input to Left Output; Left Input to Right Output
Output Impedance	50 ohms, Differential to Ground

Chapter Two

Hardware Installation

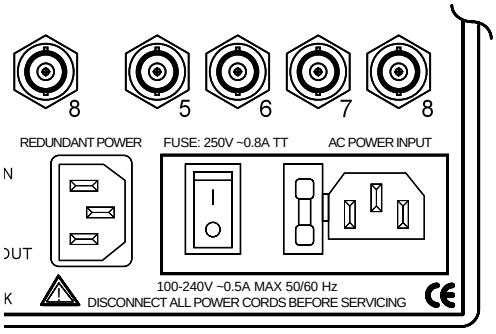
This chapter covers only the installation of the Matrix 200 hardware. Connecting its inputs and outputs is covered in Chapter 3 and setup is covered in Chapter 4.

IEC Power Panel

The IEC Power Panel consists of an On/Off switch, a fuse cover and two male power connectors. The second connector is provided for a redundant power supply.

Standard Power Supply

The Matrix 200 Series switcher/router has an auto-switching power supply that operates from any input voltage from 90 to 260 VAC, 50/60 Hz. No equipment changes are necessary.



Fuse

Fuse Type = 5mm x 20mm
Fuse Rating = 250V, 0.8A Super Slo Blo

Power Switch

Power Switch - 1 = On
0 = Off

Redundant Power Supply (optional)

To improve equipment reliability in critical applications, the Matrix 200 can be configured with a redundant internal power supply. With this option, the Matrix 200 will automatically switch to the backup supply if the primary supply fails. If the Matrix 200 switches to the backup power supply, it continues to operate without interruption and sends a command to the Host system to indicate a change in status. If the Matrix has a Front Panel Controller or QuickSwitch Front Panel Controller, the Power LED will flash to alert the user that a power failure has occurred.

To install this optional power supply, see procedure on page 2-9.

Front Panel Controller

The Front Panel Controller (FPC) provides local control of all Matrix 200 functions. This optional feature is intended to supplement normal RS-232/ RS-422 computer control with a local or remote operator control. As described in the following pages, the FPC can either be mounted on the front of the Matrix 200 or installed remotely, up to 200 feet, by means of an RJ45 cable connected to the rear panel.

Two FPCs can be connected to the same Matrix 200 - one on the front and the other located remotely and connected to the rear panel of the Matrix 200. Refer to the following pages for instructions for mounting and connecting the FPC to the Matrix 200.

The following pages include procedures for panel installation.

QuickSwitch Front Panel Controller

The QuickSwitch Front Panel Controller (QS-FPC) provides local control of all Matrix 200 functions. This optional feature is intended to supplement normal RS-232 computer control with a local or remote operator control.

Removing the Matrix 200 Cover

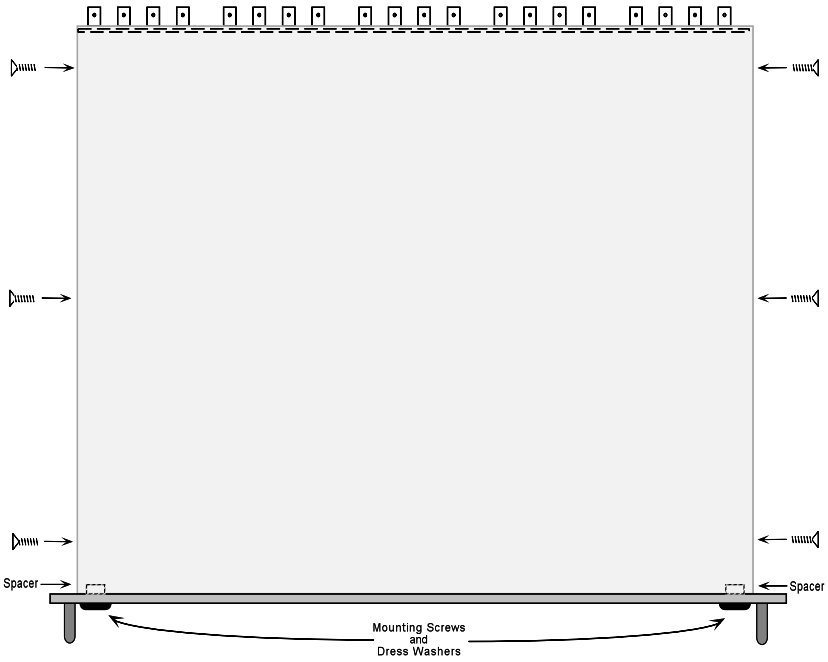
As a preliminary step, follow this procedure when making any hardware changes which require access to the interior of the Matrix 200 unit.

Caution: *The ambient temperature of the rack should not exceed 50° C. To insure proper ventilation, we recommend that you allow a minimum of one rack unit spacing above and one below the Matrix 200 if forced air cooling is not used.*

1. Turn off input power to the Matrix 200; disconnect power cord(s).

2. If the Matrix 200 is rack-mounted, remove it and place it on a clean workspace.

3. Remove the six screws that hold the top half of the Matrix cover. Lift the cover-half straight up to expose the main controller board inside. (See picture)



Note: When changing a front panel, the side panels may move when the panel is off, misaligning the panel screws with the mounting holes. With the top cover off, move the sides, if necessary, to align the holes. After the new front panel is mounted, replace the top cover.

4. Go to the appropriate installation procedure.

Caution:
Take care to remove the four spacers from the rear of the panel.

Changing Matrix Front Panels

All Matrix 200 units ship with either a Front Panel Controller (FPC), a QuickSwitch Front Panel Controller (QS-FPC), or a Blank Front Panel. There may be a need to change this configuration, such as:

- *If the FPC or QS-FPC is to be removed, for example to install it remotely, a blank front panel must be installed in its place.*

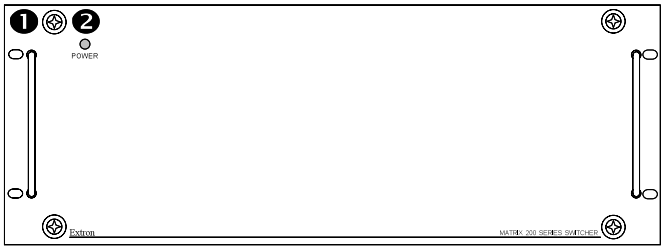
- *If the Matrix 200 Series Switcher is presently configured with the blank front panel and the optional FPC or QS-FPC is to be installed.*

If there is a need to change this configuration, refer to “Removing the Matrix 200 Cover” (above), and use the appropriate procedure from the following page.

Installing a Front Panel Controller

Remove the cover (see "Removing the Matrix 200 Cover" on page 2-2) and then do the following:

1. Remove the four No.10 screws and dress washers (items ❶ & ❷) from the Blank Front Panel.

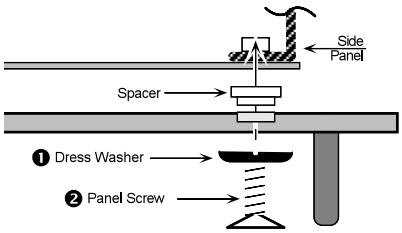


Caution:

Take care to remove the four spacers from the rear of the panel. See picture below, left.

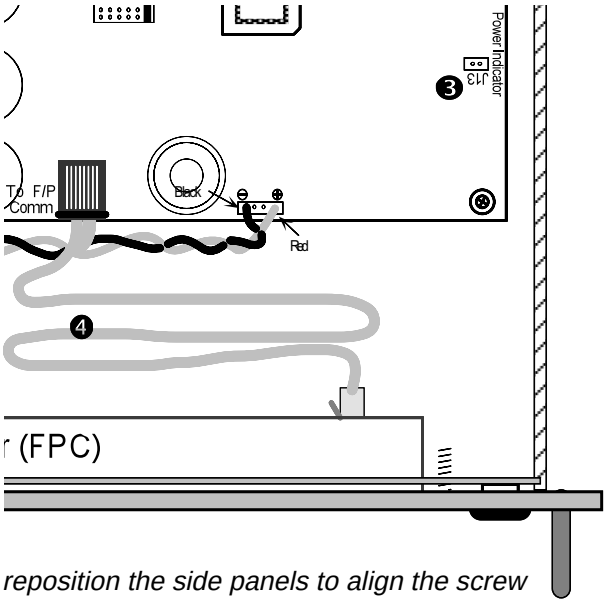
2. Disconnect the Power Indicator cable from J13 on the right side of the main controller board and remove the panel. See ❸ in the picture below right.

3. Position the FPC on the front of the Matrix 200, with a spacer behind each screw. Install the four screws and dress washers (items ❶ & ❷). This may be made easier by placing the Matrix face-up, being careful to protect the BNC connectors from damage.



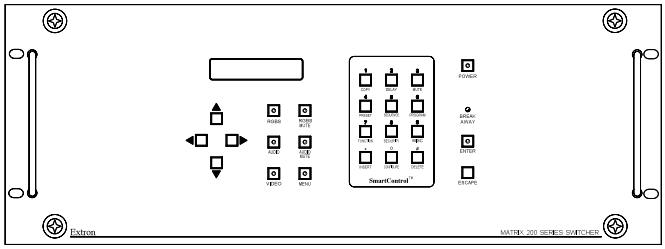
4. Connect the modular cable from the plug on the FPC to the RJ45 connector on the Matrix 200 main controller board. See ❹ in the picture to the right for connector location.

5. Reverse the above procedure to put the Matrix back together.



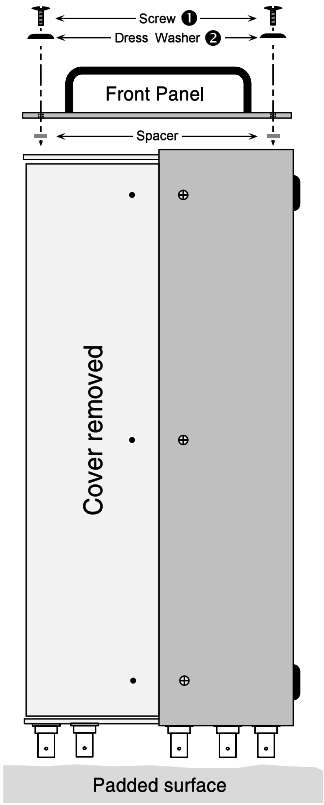
When installing a new front panel, it may be necessary to reposition the side panels to align the screw holes.

The mounted Front Panel Controller.



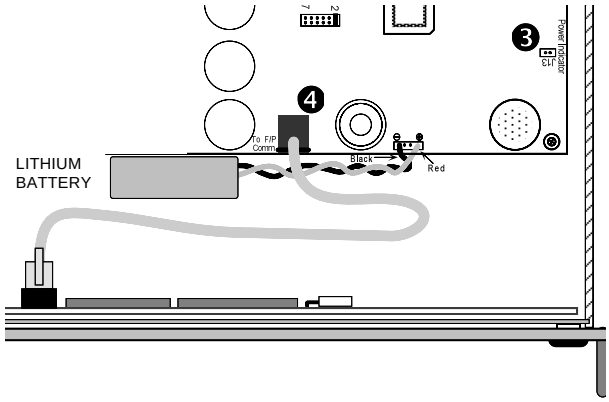
Replacing a Blank Panel with a QuickSwitch Front Panel Controller

Installing a front panel may be easier by placing the Matrix face-up, being careful to protect the BNC connectors from damage.



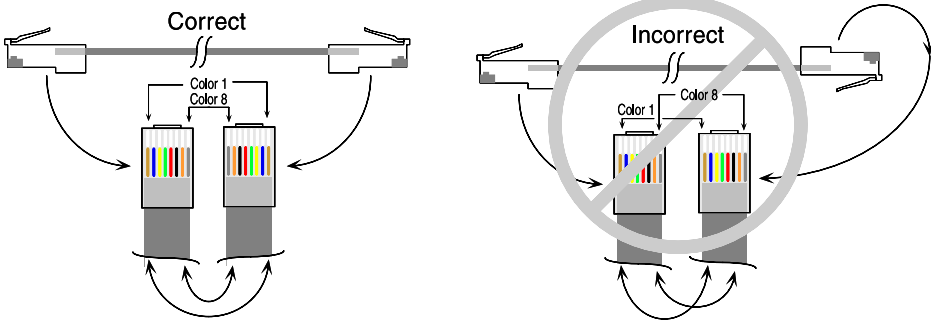
After removing the Matrix 200 cover, remove the Blank Front Panel as follows:

1. Remove the four screws and dress washers (items ❶ & ❷ at left) from the existing front panel. Take care to remove the four spacers from the rear of the panel.
2. When removing the blank panel, disconnect the Power Indicator cable from J13 on the right side of the Main Controller board. See ❸ at right.



3. Remove the Blank Front and set it aside.
4. Position the QS-FPC on the front of the Matrix 200, with a spacer behind each screw. Install the four screws and dress washers (items ❶ & ❷).
5. Connect the modular cable from the plug on the QS-FPC to the RJ45 connector on the Matrix 200 Main Controller board. See ❹ in the picture above for the RJ45 connector location.

Circuits may be damaged by using the wrong RJ45 cable. See figure below for correct orientation of cable conductors.



6. Refer to page 2-2 when reassembling the Matrix 200.

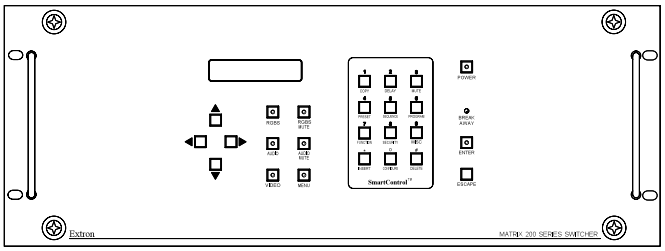
Operating instructions for the QS-FPC are found in Chapter 4.

Installing a Blank Front Panel

Remove the cover (see "Removing the Matrix 200 Cover" on page 2-2) and then do the following:

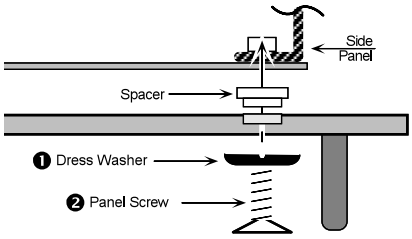
1. Disconnect the modular cable from the plug on the FPC to the RJ45 connector on the Matrix 200 main controller board. See ❹ in the picture below for the connector location.

2. Remove the four No.10 attaching screws and dress washers (items ❶ & ❷ in pictures below) from the front panel and remove the panel.



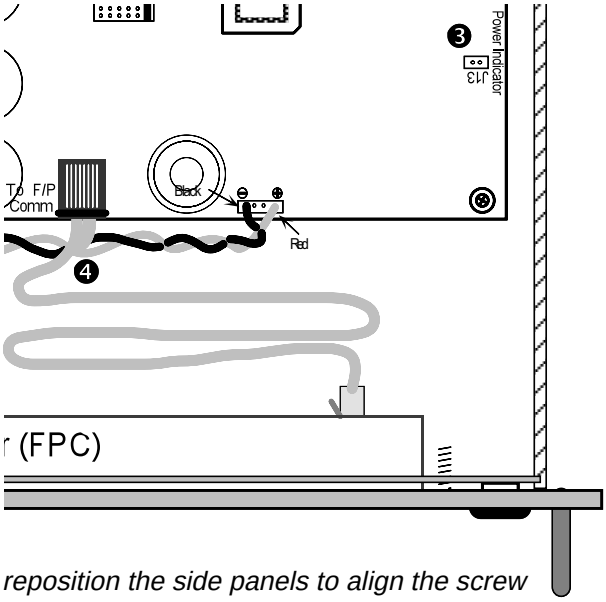
Caution:

Take care to remove the four spacers from the rear of the panel. See picture below, left.



3. Position the blank panel on the front of the Matrix 200 with a spacer behind the panel for each screw. Install the four screws and dress washers. (See ❶ & ❷ in left picture.) This may be made easier by placing the Matrix face-up, being careful to protect the BNC connectors from damage.

4. Connect the Power Indicator cable from the Blank Front Panel to J13 on the right side of the main controller board. See ❸ in the picture to the right.



5. Reverse the procedure for removing the cover to reassemble the Matrix.

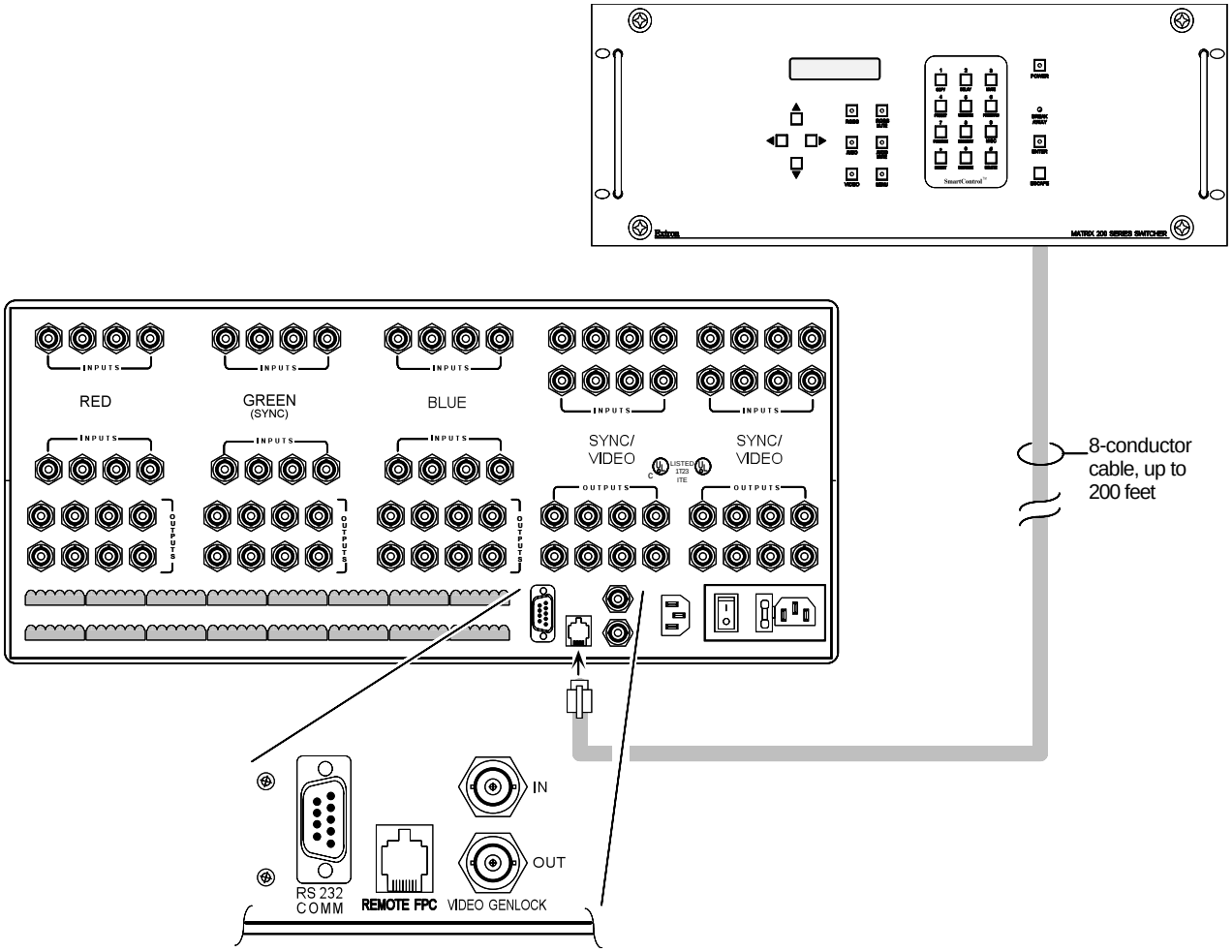
When installing a new front panel, it may be necessary to reposition the side panels to align the screw holes.

If the FPC is to be installed remotely, refer to the following procedure.

Installing the FPC for Remote Operation

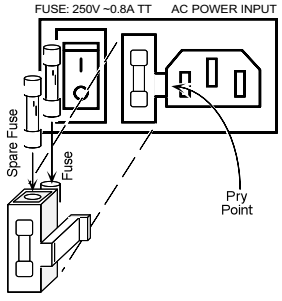
The rear panel of the Matrix 200 has an 8-conductor RJ45 connector used to plug a cable from a remote FPC. The remote FPC can be used independently, or as a second FPC, in parallel with one mounted to the front of the Matrix 200. The use of one or more FPCs does not interfere with normal RS-232/RS-422 control of the Matrix 200 switcher.

The diagram below shows the cable connection from the remote FPC to the Matrix 200. The remote panel can be mounted in another rack, or any convenient location.



Changing the Main Fuse

To change the AC power fuse, you must first unplug the IEC power cable. This allows access to the fuse holder. Use a small, flat screwdriver to press into the notch and pull the holder straight out. There is a storage place for a spare fuse. Replace the blown fuse* (see picture right) and slide the fuse holder until it snaps in place.



There is also an AC fuse on each of the two boards that make up the power supply. Each fuse is located next to the AC input connector. These fuses are accessible by removing the top cover of the Matrix.

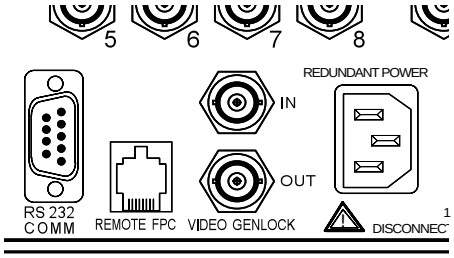
* Use 250V, 0.8A Super Slo Blo Fuse

RS-232/RS-422 Communications

The Matrix 200 can be controlled by a host system through an RS-232/RS-422 interface. The interface allows the user to write programs to configure and automate the operation of the Matrix 200. This includes making changes dynamically when commanded by the host controller and when informing the host of the Matrix status. Certain important changes in status are reported to the host automatically. For additional programming information, refer to Appendix B.

9-Pin RS-232/RS-422 Connector

The RS-232/RS-422 connector is a standard 9-pin D subminiature female receptacle with the following pin designations:



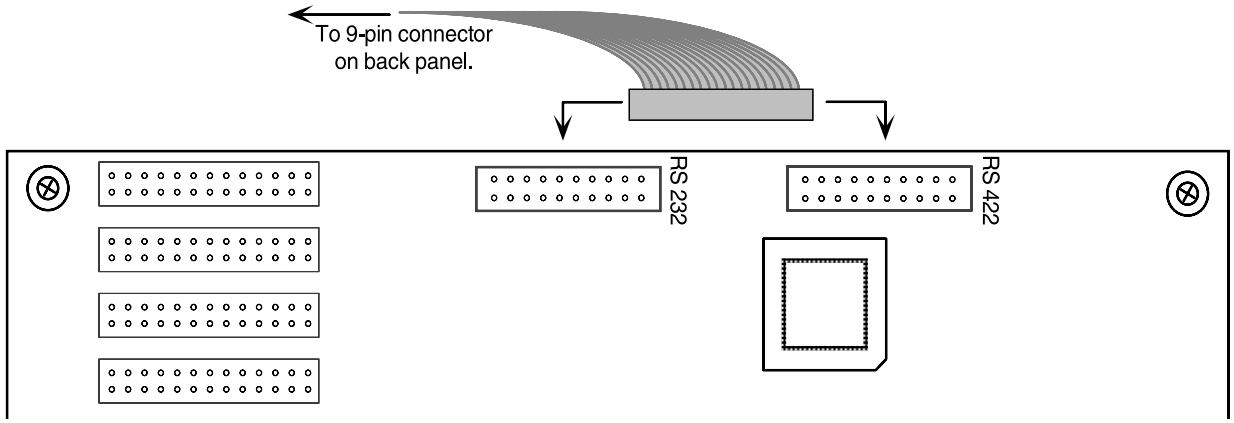
Pin	RS-232	Description	RS-422	Description
1	—	No Connection	TxD (-)	Transmit Data (-)
2	Tx	Transmit Data	TxD (+)	Transmit Data (+)
3	Rx	Receive Data	Rx (+)	Receive Data (+)
4	—	No Connection	Rx (-)	Receive Data (-)
5	Gnd	Signal Ground	Gnd	Ground
6	—	No Connection	—	No Connection
7	—	No Connection	—	No Connection
8	—	No Connection	—	No Connection
9	—	No Connection	—	No Connection

RS-232/RS-422 Protocol

The RS-232/RS-422 baud rate is selectable from the Miscellaneous Menu, see Chapter 4. The default protocol is 9600-baud, 8-bits, no parity, 1 stop bit, X-On/X-Off.

Swapping the RS-232/RS-422 Port cable

The rear panel of the matrix has a single 9-pin connector labeled “RS-232”. The Main Controller board provides two connectors – one for RS-232 and the other for RS-422. Each matrix ships with the cable connected to the RS-232 port on the Main Controller board. If your system uses RS-422, you may change this connection on the Main Controller board as shown below. See page 2-2 for instructions on removing the Matrix 200 cover.



Checksum Disable Jumper

The Matrix 200 is shipped with JMP3 installed to disable the Checksum feature. To enable it, remove the top cover (page 2-2) and remove JMP3. See picture below.

Note: When Checksum is disabled, the Cks1 and Cks2 bytes must still be included. They must be data bytes (have a value between 80h and FFh).

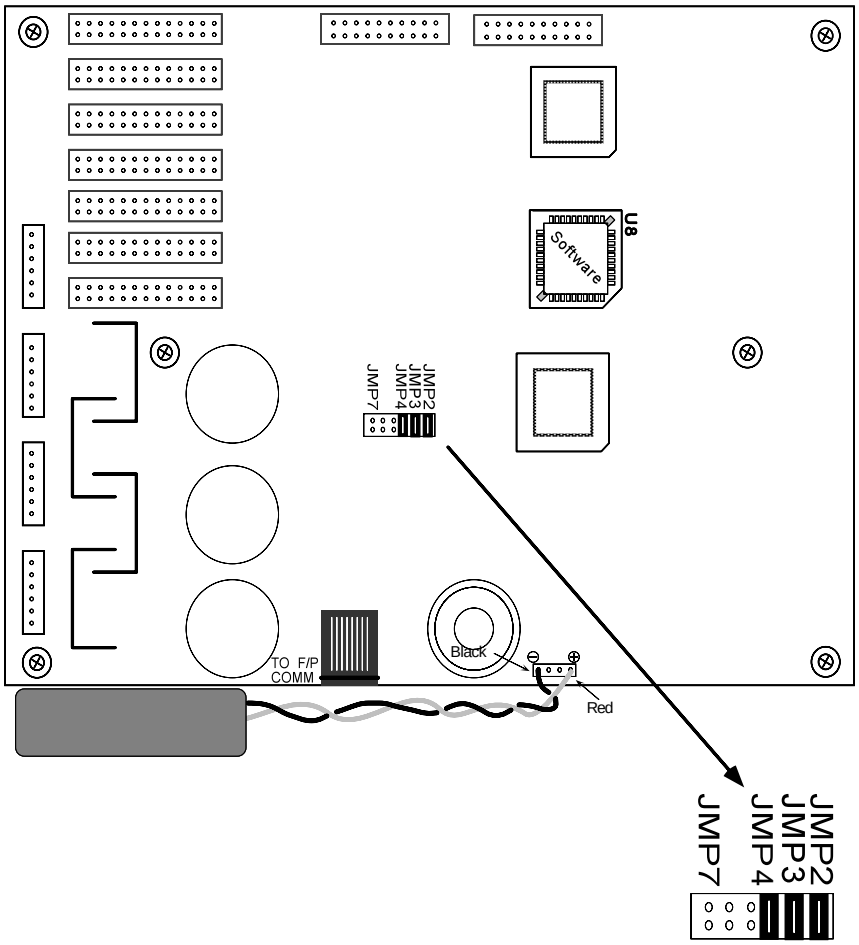
Enabling the Part Number Jumper

The Matrix 200 reports its unit part number if the JMP4 jumper on the main board is installed. This jumper has no other effect on the system and is factory set.

Installing the Security Jumper

The security code feature is described in Chapter 1, and implemented in Chapter 4, menu 8. It can only be used if JMP2 is installed.

Note: If the security is set and the code is not known, you cannot access the Matrix. Remove this jumper and reinstall it to unlock the Matrix and reset the code. At some point in time, power must be applied with the jumper out for the controller to recognize this change. To reactivate the security feature, reinstall JMP2 before putting the cover back on.



Installing a Redundant (second) Power Supply

To install a redundant power supply in a Matrix 200, disconnect the power source, remove the Matrix from its rack mount, and place it on a clean workspace. Refer to page 2-2 to remove the cover. With the cabinet open, do the following:

1. Mount the new power supply on the four bolts projecting up from the bottom of the cabinet and secure it with four nuts. This position is parallel to that of the primary power supply. (See dotted lines in picture.)

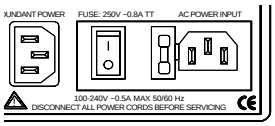
2. Connect the two twisted power cables from the second IEC connector to the inputs on the new power supply boards. See dotted lines in picture below.

3. Connect the two black power output connectors to the two vacant connectors on the main controller board - next to the connectors from the primary power supply.

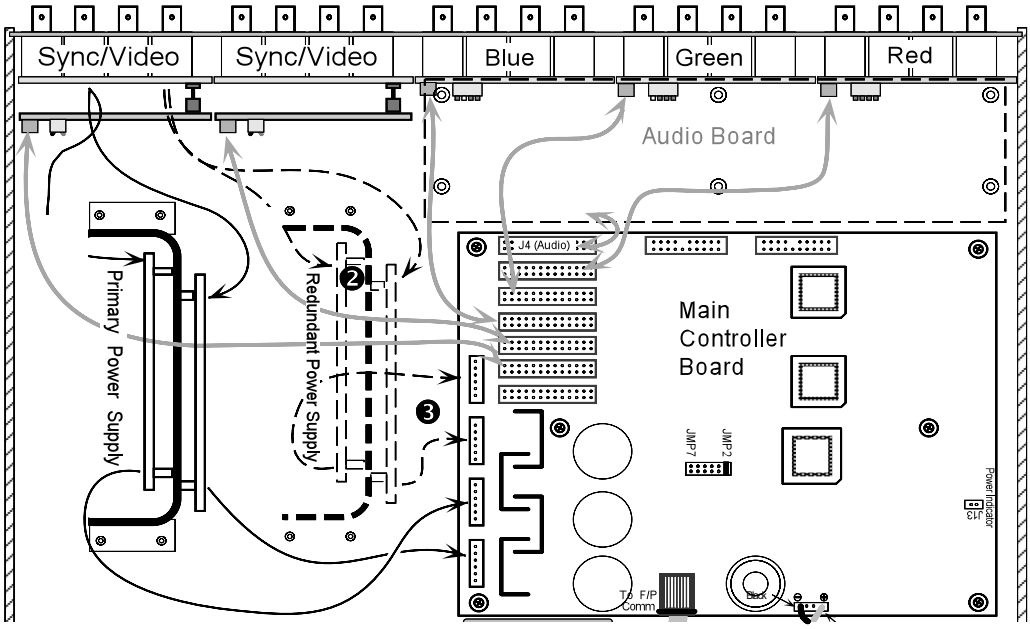
4. Check the mounting and connections by comparing them with those for the primary power supply.

5. Put the Matrix 200 back together and connect **both** AC power sources.

6. To check the operation of the redundant supply, turn the AC switch Off. The Matrix should function normally using the redundant power supply. If using an RS-232/RS-422 interface, the Matrix Status Bytes will indicate this condition.



Like the primary power supply, the redundant supply has a 2-amp, fast-blo fuse at the AC input of each board.



Before Installing I/O Modules

Before adding an I/O Module to an existing Matrix 200, you must know the revision status of the Matrix. Page A-1 has a list of option kits and their part numbers. It also explains what upgrades may be required before adding modules.

If the serial number has an "A" after it, the Matrix is ready for an Audio Module.

If the unit does not meet these requirements, go to the appropriate procedure to bring it up to date and then do the Audio Installation.

Adding an Audio Module

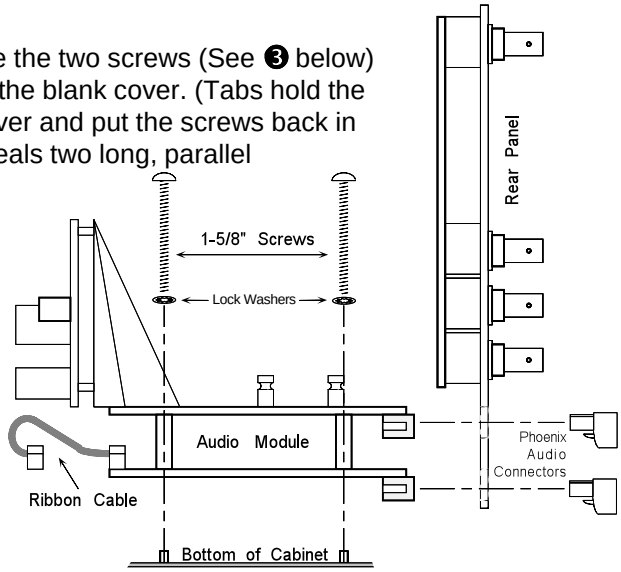
Do not use this procedure unless your Matrix 200 is up to date. See previous page.

Tools for Installation:
3/16" flat screwdriver
#4 Phillips screwdriver
#6 Phillips screwdriver
Wire cutters

1. Remove the Matrix top cover (procedure on page 2-2).

2. Locate the gray ribbon cables that connect the Main Controller board to the existing I/O modules (Red, Green, Blue and Sync/Composite Video). Note the orientation of the red stripe on each ribbon cable and unplug both ends. If necessary, cut the ties that bind them together. It is not necessary to mark the cable connections; this will be covered later. Place the ribbon cables aside.

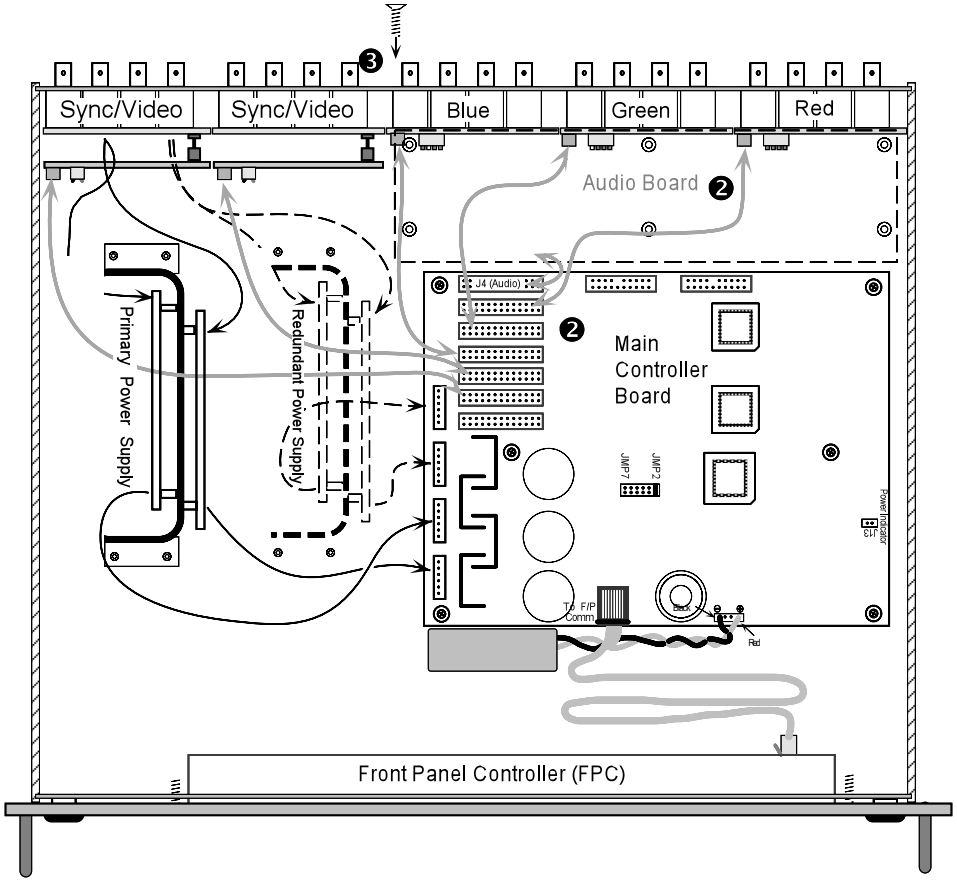
3. On the rear panel, remove the two screws (See ❸ below) that hold the right end of the blank cover. (Tabs hold the left end.) Remove the cover and put the screws back in the same holes. This reveals two long, parallel access slots. These will accommodate the upper and lower sections of the Audio Module.



Audio Option Kit:

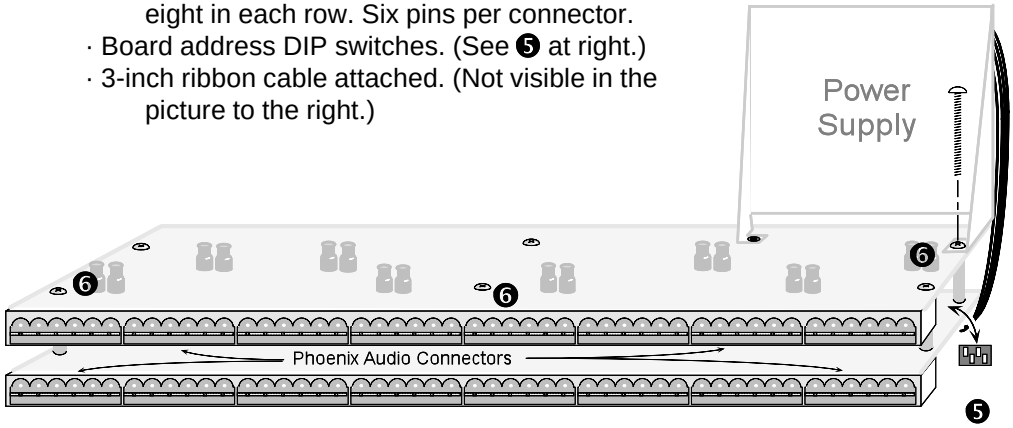
Qty	Description
6	Internal Tooth Lock Washers
1	Audio Module with:
1	3" Ribbon Cable
6	1-5/8 Screws
16	Phoenix Connectors

4.Check the installation parts list and identify them by their location in the picture to the right.



5. Unpack the Audio Matrix module and locate the following:

- The bracketed attachment is the power supply.
- Two rows of female Phoenix audio connectors, eight in each row. Six pins per connector.
- Board address DIP switches. (See ❺ at right.)
- 3-inch ribbon cable attached. (Not visible in the picture to the right.)

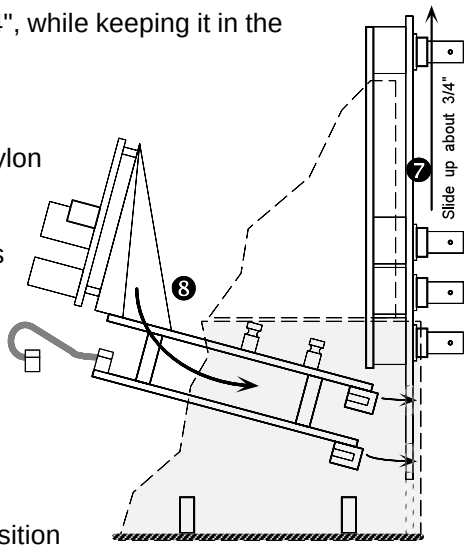


The address DIP switches are factory-set. See right end of picture above. They should be set to represent an address of five (0101 binary).

6. Remove the six nuts from the screws that hold the two boards together. Set the screws and washers aside; the nuts will not be needed. (See ❻ above.)

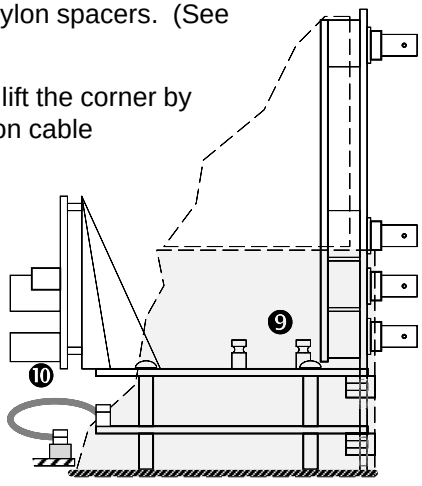
7. Slide the rear panel upward about 3/4", while keeping it in the cabinet grooves. (See ❼ right.)

8. Orient the Audio Module above the nylon spacers, with the audio connector strips to the rear. Tilt the module slightly and slip the audio connectors through the parallel openings in the rear panel and lower it to a horizontal position. (See ❽ right.)



9. While holding the Audio Module in position with the rear panel, lower them both carefully until the module rests on the six nylon spacers. (See ❾ below.)

10. With the Audio Module loosely in position, lift the corner by the power supply slightly and plug the ribbon cable into the nearest slot (J4) on the Main Controller board.

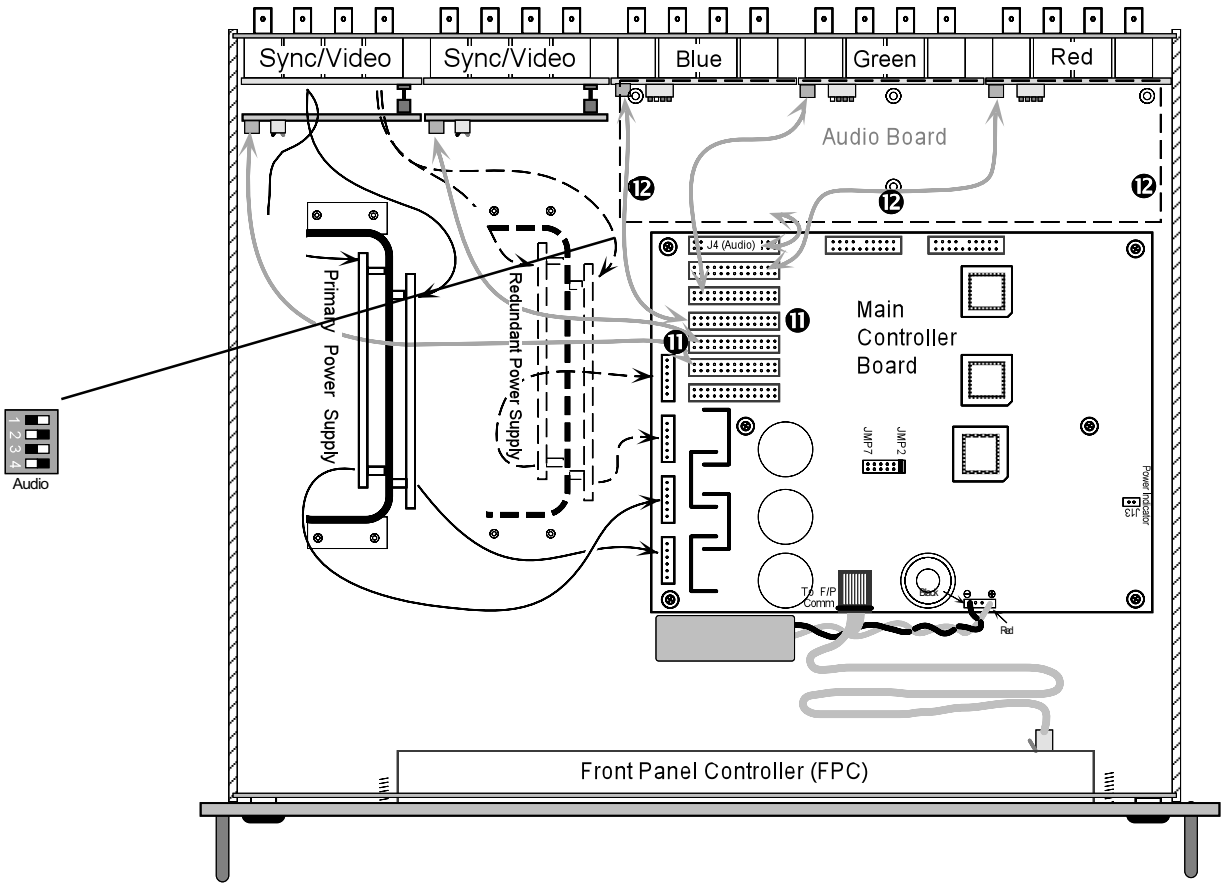


The I/O connectors on the Main Controller board are on a parallel bus, therefore it doesn't matter which module is plugged to which connector. Because of its cable length, the Audio Board must plug into the closest connector.

11. Plug the remaining I/O Ribbon cables from each module to a connector on the Main Controller board (See ⓫ below). Since the Main Board connectors are the same, connect the cables for neatness and convenience. For example, the illustration below shows the Red I/O module connected to J5, the Green to J6, etc.

Warning: *When working close to the other I/O modules, be careful that you do not change any other DIP switch settings.*

12. Be sure the cables are securely plugged into the Main board, and then drop the six screws into the six holes in the Audio Module (See ⓬ below). Wiggle each screw by hand to align it with the threads below and tighten them with a screwdriver.



*The red stripe on the ribbon cables (pin 1) is to the **right**, on the Main Controller and Audio boards. (See the picture below.) It must point **up** on the other I/O modules.*

13. With all connections and screws secure, route the cables away from the power supplies. Use tie wraps to tie cables together where they follow the same path.

14. If no other modifications are required, put the top cover back on the Matrix 200 and put it back in its working position.

If the Matrix has an FPC, the new Power On message will show “A” in position 6. See example. Other digits depend on the configuration. The new configuration will also appear in Request ID information sent to the Host system via the RS-232/RS-422 port.

```
MATRIX 200
8X8    RGBHVA_
```

If other modifications are required, go to the appropriate procedure.

Installing I/O Modules in the Rear Panel

Tools for Installation:
3/16" flat screwdriver
#4 Phillips screwdriver
#6 Phillips screwdriver
9/16" Socket/nutdriver

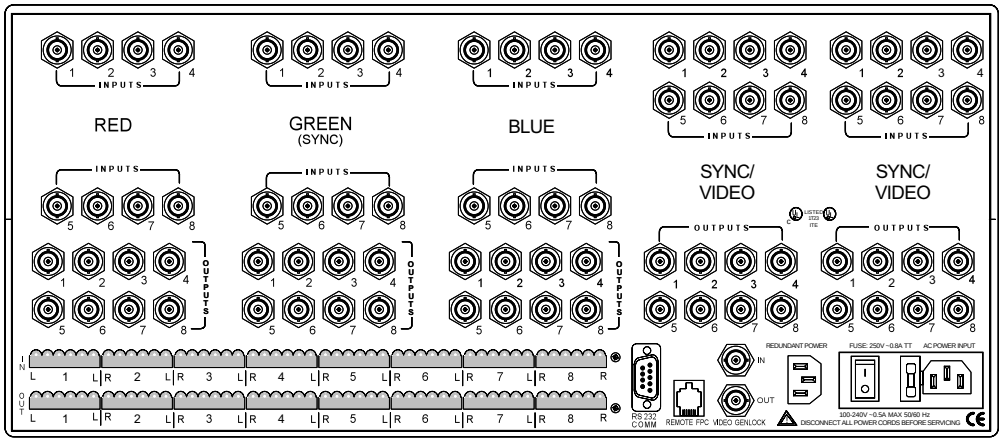
There are three types of modules that can be installed in the rear panel of the Matrix 200: HRAM module, for RGB; Sync module, for Horizontal and/or Vertical Sync; and Composite Video module for Composite Video or S-Video. Positions, or "planes" 1, 2, and 3 will accommodate only HRAM modules. Planes 4 and 5 will accommodate either Sync or Composite video modules, but not HRAM. A Matrix unit cannot have one or two HRAM modules; it must have three (for red, green and blue) or none.

Use this procedure to install any HRAM, Sync or Composite Video module. Locate the position on the back panel for the new module. An HRAM can only be installed in the locations marked Red, Blue or Green. A Sync module or a Composite Video module can only be mounted in the positions marked as such. If there is one sync module, it must be in the first position after the Blue, or Plane 4.

Configuration	plane 1	plane 2	plane 3	plane 4	plane 5
RGsB	HRAM	HRAM	HRAM	-	-
RGBS	HRAM	HRAM	HRAM	Sync	-
RGBHV	HRAM	HRAM	HRAM	Sync	Sync
RGBSCv	HRAM	HRAM	HRAM	Sync	C-Video
1 Cv	-	-	-	C-Video	-
2 Cv or 1 YC	-	-	-	C-Video	C-Video

Audio can be included with any of these combinations.

Address switches are set according to the physical location. The illustration here shows the modules already installed.



1. Remove the Matrix top cover (procedure on page 2-2).

2. Locate the gray ribbon cables that connect the Main Controller board to the existing I/O modules and determine where the new module will be connected. If cables from adjacent modules are in the way, they may be unplugged and reconnected later.

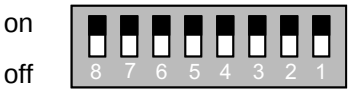
3. On the rear panel, remove the 16 round plastic plugs that cover the holes where the new module will be installed.

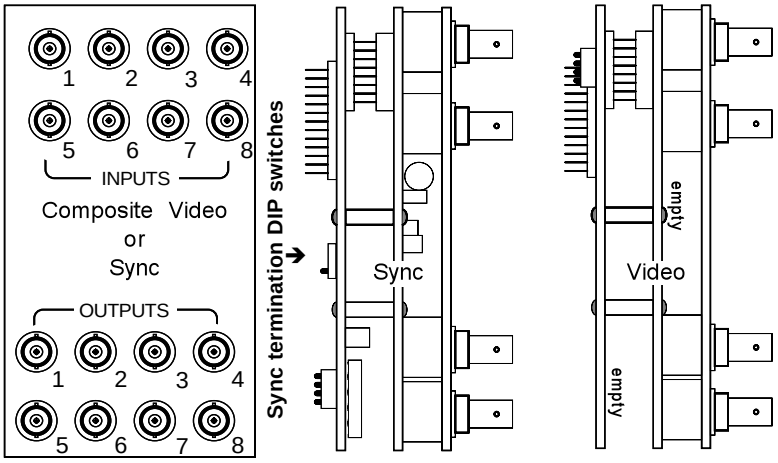
4. On the new module, remove the nuts from the 16 BNC connectors.

If installing both a Sync module and a Composite Video module, the Sync module must be in Plane 4 and the Composite Video in Plane 5.

The picture to the right shows some physical differences between these two modules. The Sync module has some components placed on the insides of the boards, while the Composite Video module has none.

The Sync termination DIP switches below will be set for 75 ohms (on) or 510 ohms (off). The switches (1 - 8) correspond to the inputs on the right (1 - 8).





Sync termination DIP switches

on = 75 ohms
off = 510 ohms

Configuration examples:

8 x 8 = 8 switches on (1 - 8)
8 x 4 = 8 switches on (1 - 8)
4 x 4 = 4 switches on (1 - 4)

5. Mount the module by inserting the BNC connectors through the holes in the rear panel and secure it in place with the 16 nuts. (Use 9/16" socket.)

6. Verify that the address DIP switches are set for the correct Plane number. These switches are set at the factory, but their settings should be confirmed.

The address switch settings are shown to the left, with their orientation as seen from the front of the Matrix 200.

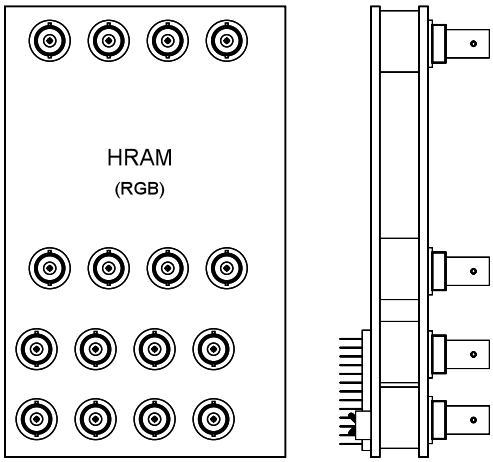
7. Carefully support the I/O board while pushing the ribbon cable onto its connector (Red stripe up). Connect the other end to the Main Controller board. The connectors on the Main Controller board are the same, therefore the cables can be arranged for neatness. Note the orientation of the red stripe (pin 1) is to the right when looking from the front of the Matrix.

8. After rechecking all connections, replace the cover on the Matrix 200 and secure it with the six screws. (See page 2-2.)

9. If the Matrix has a Front Panel Controller, when power is applied the LCD message will indicate the new configuration. The example here shows Red, Green, Blue, Horizontal & Vertical Sync and Audio. If the Matrix had only RGB, and one Sync module and one Composite Video module had been added, the display will read: RGBSC_ _.

The new configuration will also appear in Request ID information sent to the Host system via the RS-232/RS-422 port.

The picture to the right is for an HRAM module.

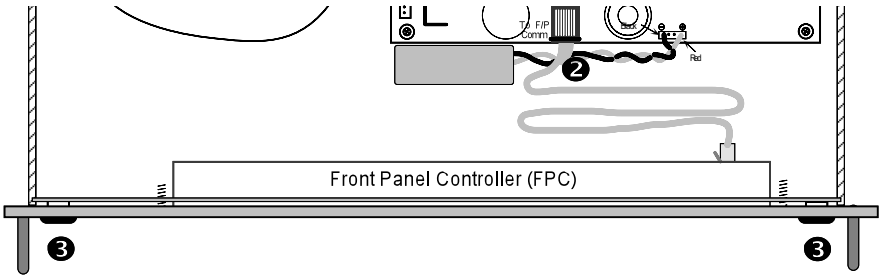


Installing FPC/QS-FPC Software Update

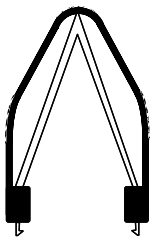
1. If the FPC/QS-FPC is mounted on the Matrix 200, refer to the procedure on page 2-2 to open the cabinet and then continue with step 2.

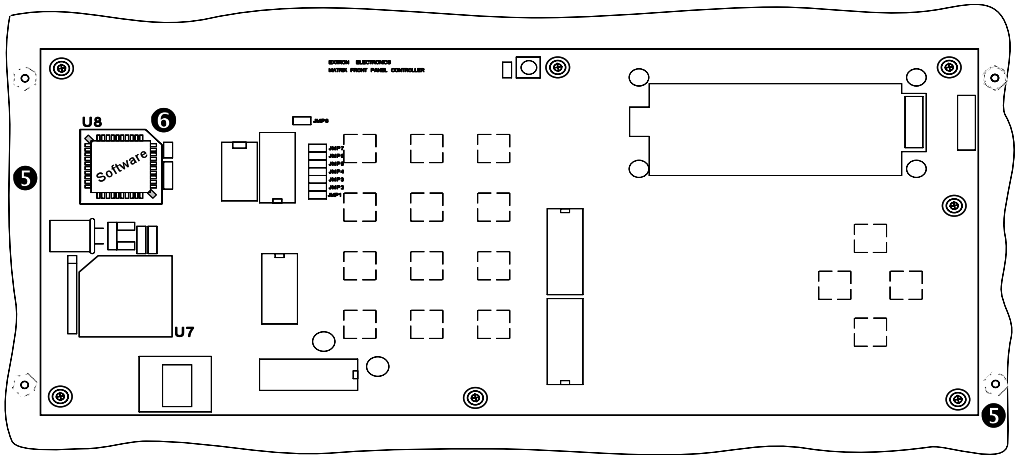
Electro-Static Discharge (ESD) can damage IC chips, even when it is not enough to be humanly detected (felt, heard or seen). Do NOT touch IC chips without being electrically grounded.

2. With the top cover off the Matrix, unplug the cable that connects the FPC/QS-FPC to the Main Controller board and put it aside.
3. Remove the four (4) screws that hold the FPC/QS-FPC to the Matrix cabinet.
4. Place the FPC/QS-FPC face down on a clean workspace. If necessary, place it on a soft pad to prevent damage.
5. Using a 1/4" nut driver, remove four (4) 1/4" nuts that hold the cover on the back of the FPC/QS-FPC.



6. After first properly grounding yourself, use the PLCC IC puller to remove the old Software chip. Squeeze the tool to align the hooks with the slots provided in opposite corners of chip socket U8. Insert the hooks, squeeze gently and pull the IC straight out of the socket. Set the chip aside.
7. Note the orientation of the angled corner of the new Software chip. Position this to match the angled corner of the socket and carefully press it in place.


PLCC Chip Puller



8. Reinstall the cover on the back of the FPC/QS-FPC and reverse the above procedure to put the Matrix back in place.

3

Chapter Three

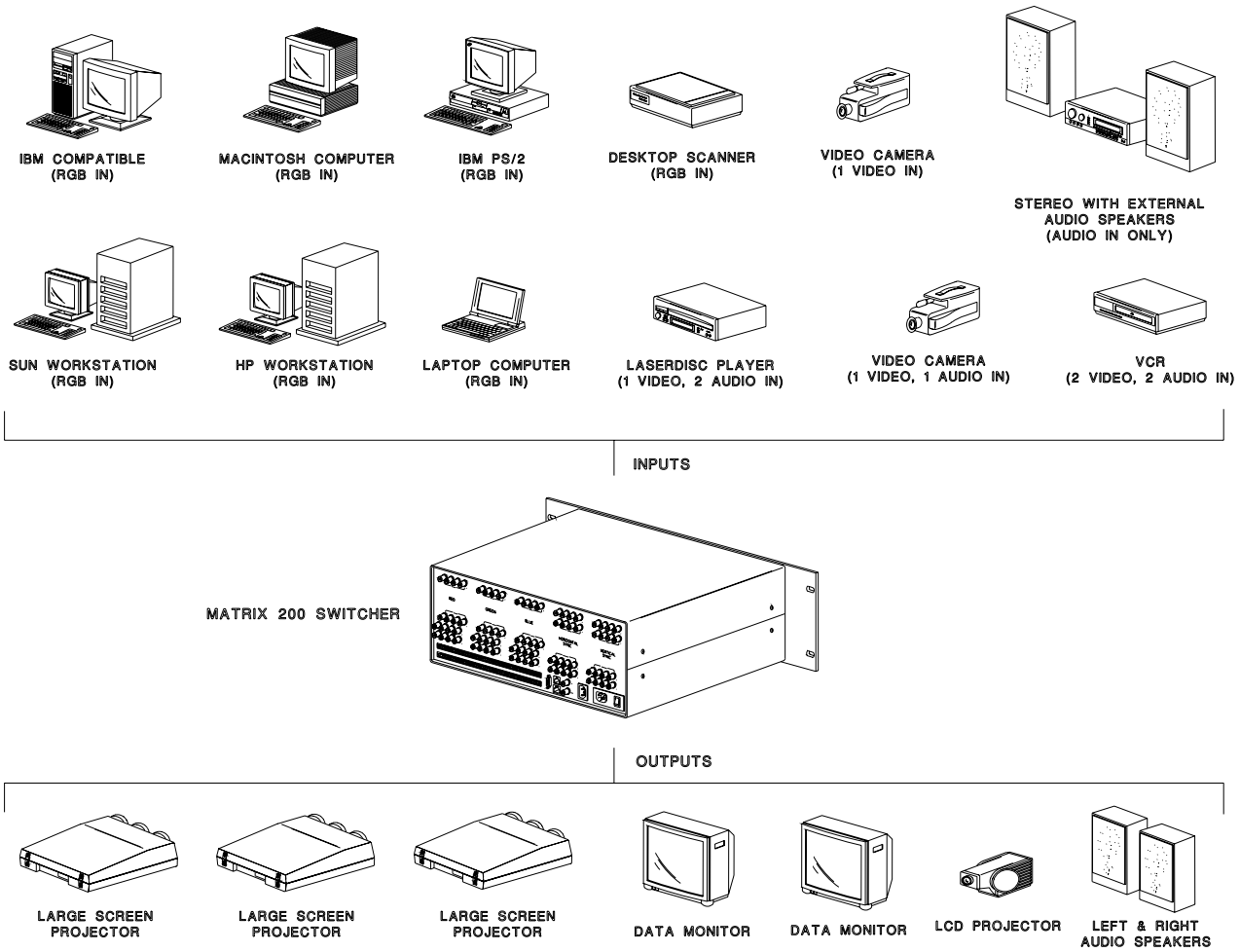
Rear Panel Connections

Multi-Output Connection

When using the Matrix 200 to switch different types of video signals, the signal output from the switcher is in the same format as the corresponding input. That is, RGB and Sync (composite or separate H&V) signals will pass through the RGB and SYNC output; NTSC and PAL video signals will pass through the composite video output; and S-Video will pass through the S-Video output. Therefore, if multiple input signal types are used in the same switcher, the same multiple outputs must also be directed to the output devices.

In the diagram below, the Matrix 200 supplies RGB output for large screen projectors and data monitors, composite video output for an LCD projector, and audio output for a stereo audio system.

The following pages show possible connections.

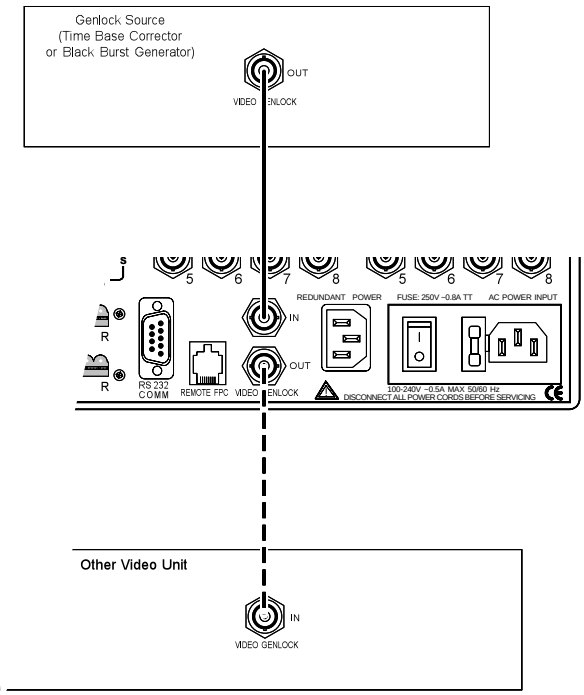


MATRIX 200 SERIES APPLICATION DIAGRAM
(PICTURED: 8x8 MATRIX CAPABLE OF 8 RGB, 8 VIDEO AND 8 AUDIO INPUTS/OUTPUTS)

Genlock Connections

The Matrix 200 is designed to use an external Genlock signal to synchronize composite video or S-video switching. If connected, Genlock can be programmed either from the optional Front Panel Controller, or from a Host system (through the RS-232/ RS-422 port).

The illustration here shows the Genlock connections. The Genlock Out connector simply allows the signal to be passed on to another video device; it does not have to be connected for Matrix operation.



RGB Input Connections

All RGB input and output connections to the Matrix 200 are made with BNC type connectors. Many types of RGB output devices (scan doublers, document cameras, etc.), including most computers, do not have BNC video output connectors. If not, a suitable adapter or an Extron computer-video interface should be used to adapt the device output to the BNC input of the Matrix 200. With the proper adapter, the RGB and Sync signals can be connected directly to the R, G, B, H, V inputs of the switcher. If the RGB signal is using the Sync-on-Green channel, connect the RGB cables to the switcher without using the sync channels.

RGB input connections to the Matrix 200 can be made using the following combinations:

Without Audio

RGsB - Red, Sync-on-Green, Blue

RGBS - Red, Green, Blue, and Composite Sync

RGBHV - Red, Green, Blue, H&V Sync

With Audio

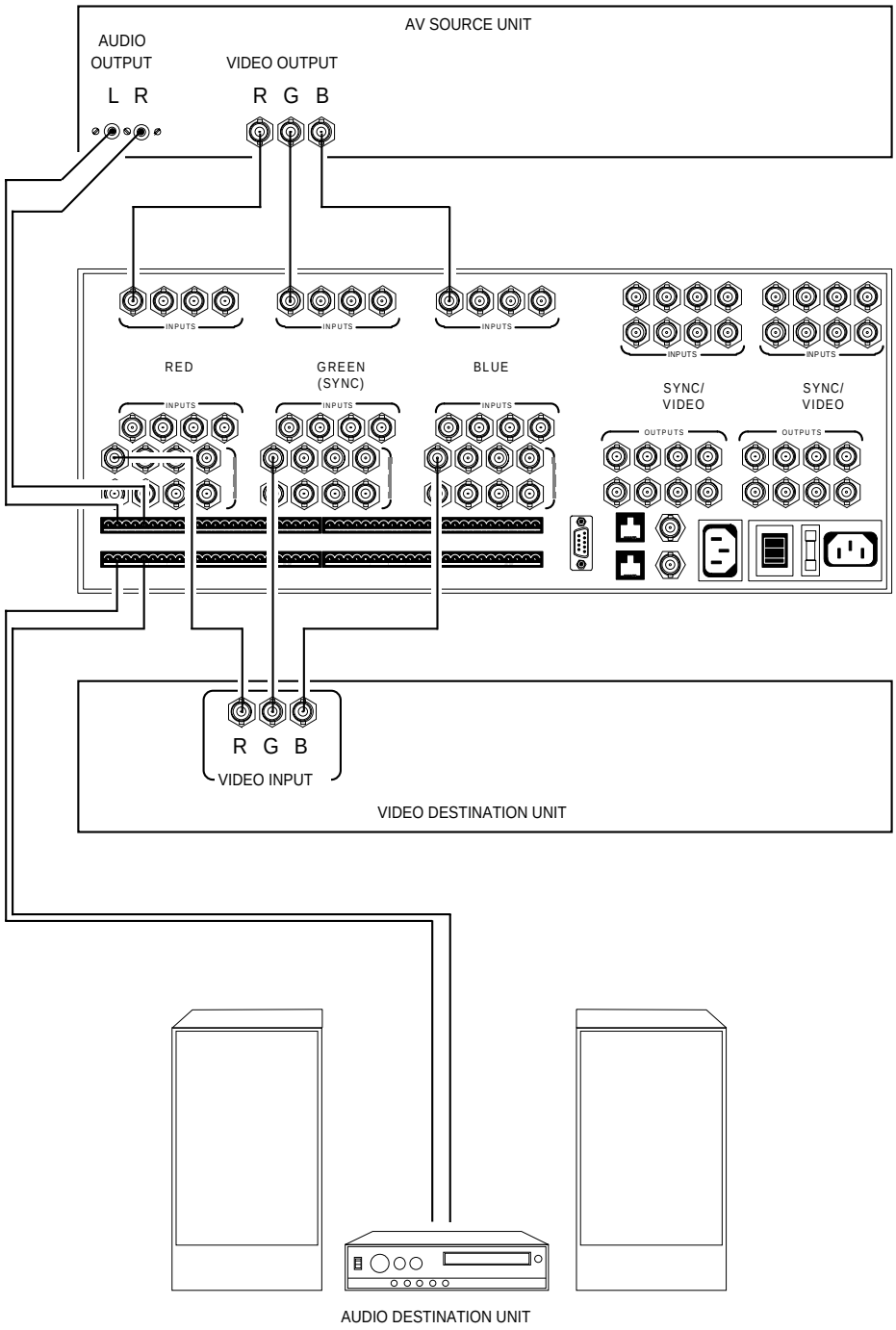
RGsB with R&L Audio - Red, Green, Blue, and Audio Follow

RGBS with R&L Audio - Red, Green, Blue, Sync and Audio Follow

RGBHV with R&L Audio - Red, Green, Blue, H&V Sync and Audio Follow

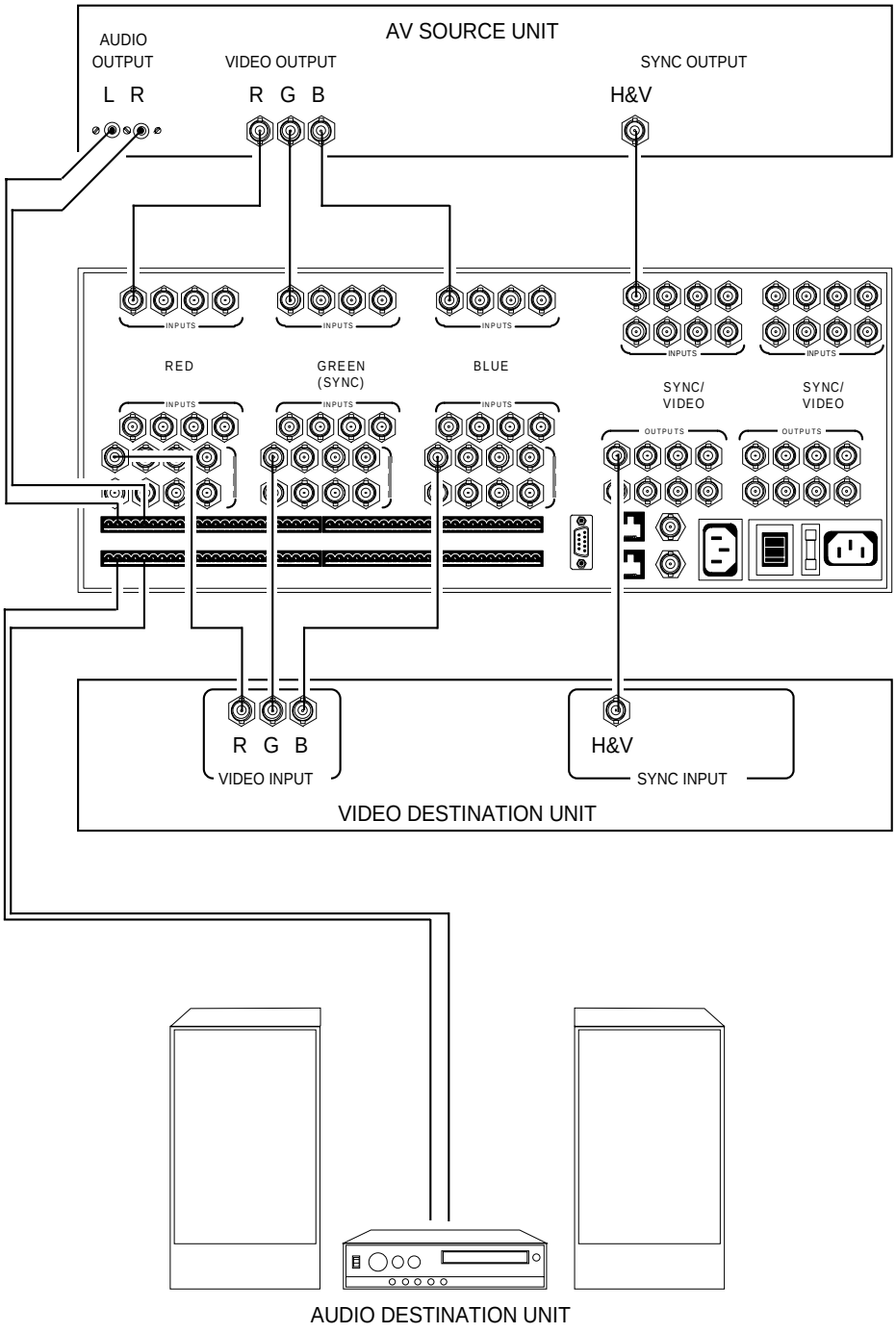
The following three pages illustrate examples for the above combinations with Right and Left Audio connections.

RGB Input Connections with Right & Left Audio



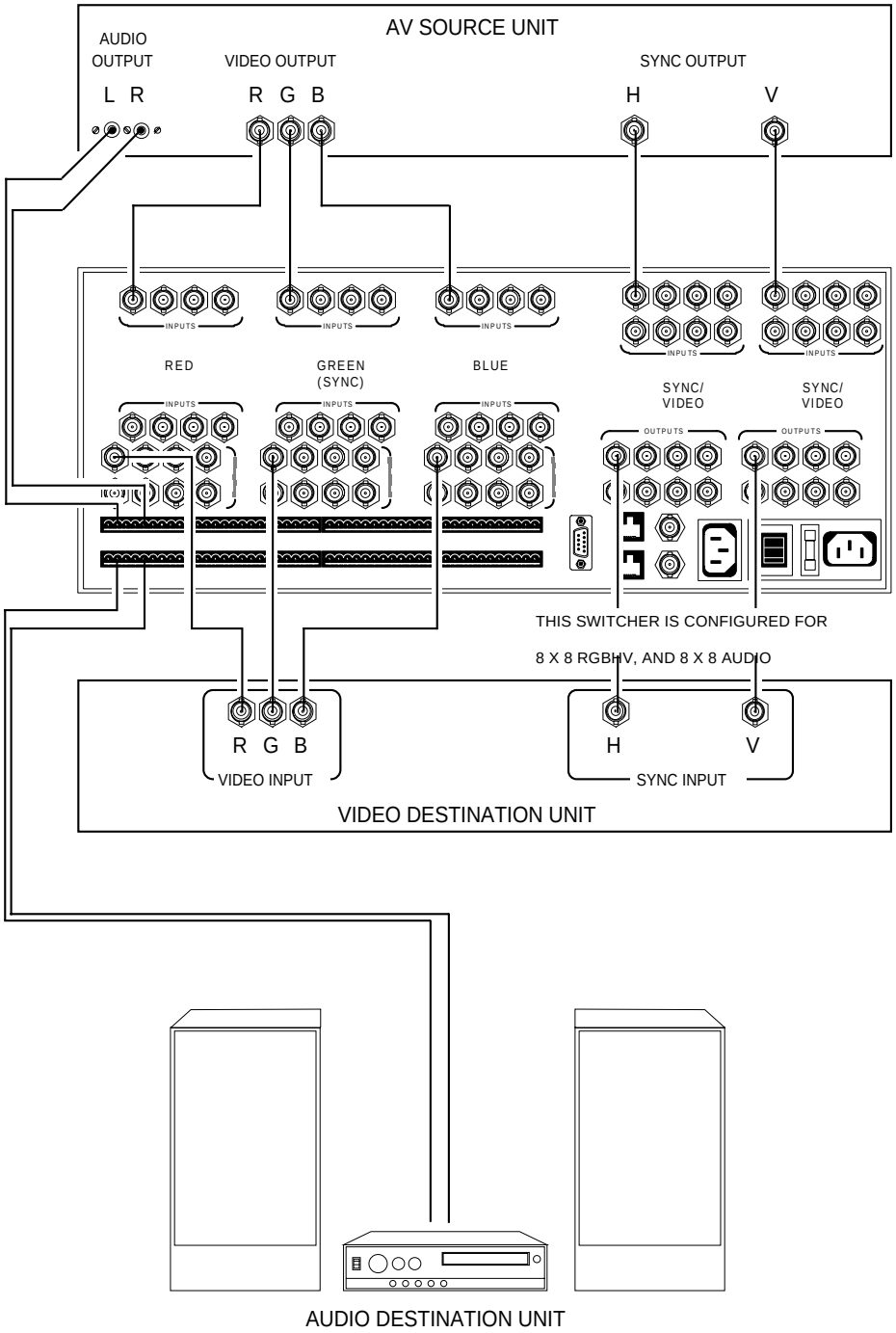
Audio Connections may or may not be used. See page 3-9 for wiring.

RGBS Input Connections with Right & Left Audio



Audio Connections may or may not be used. See page 3-9 for wiring.

RGBHV Input Connections with Right & Left Audio



Audio Connections may or may not be used. See page 3-9 for wiring.

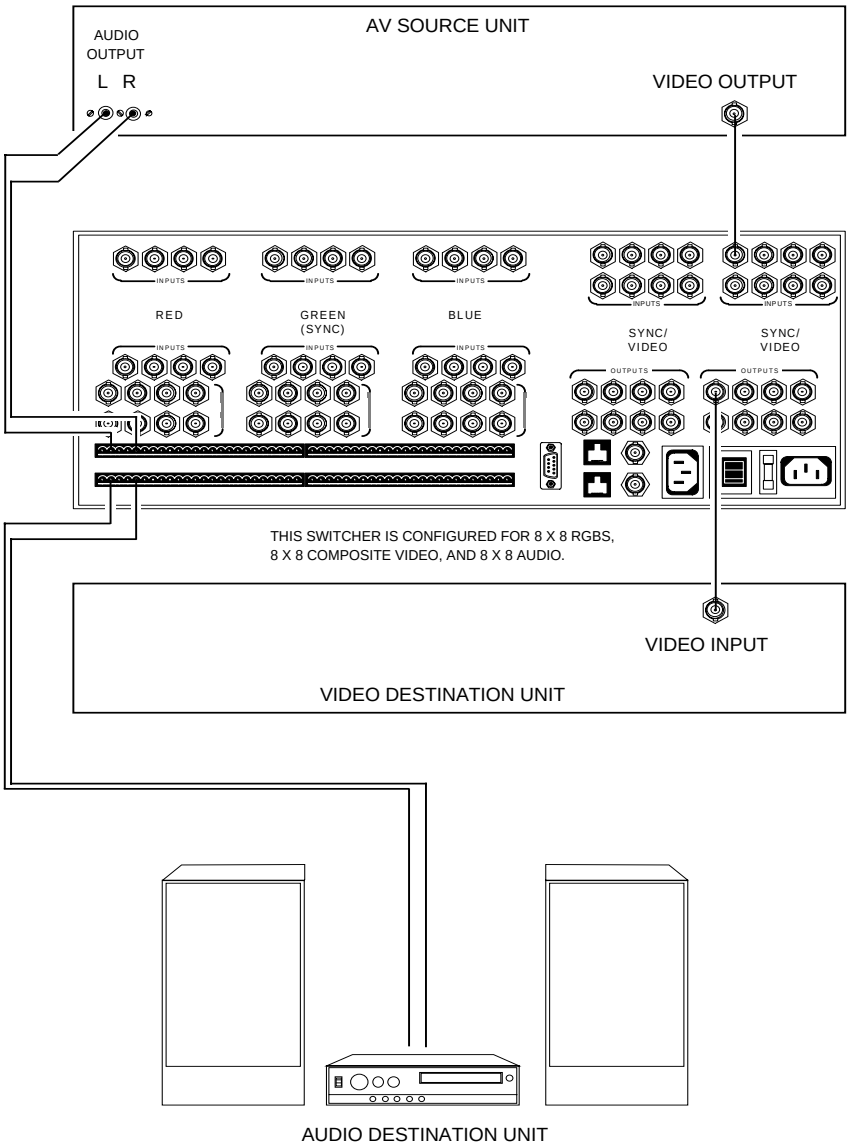
Composite Video Input Connections

NTSC and PAL are television or VCR type signals on a single coax cable, which may or may not have stereo audio. For this application, the Matrix 200 uses one Composite Video module, shown below in the right-most position. Possible uses include: NTSC or PAL, with or without right & left audio follow.

Connect the output of an NTSC/PAL video source to a Video module input. (See illustration below.) Connect the video output from the Matrix to a destination device that uses Composite Video.

NTSC - National Television Standards Committee
PAL - Phase Alternation Line

Composite Video Input with Right & Left Audio



Audio Connections may or may not be used. See page 3-9 for wiring.

S-Video Input Connections

S-Video (S-VHS) is typically the output from the AV source on a 4-pin miniature din-type connector and must be converted to 2 BNC type connectors - one for Chroma (C) and the other for Luminance (Y).

For S-VHS to BNC interface, use Extron cable 26-353-01.

To connect S-Video to the Matrix 200, the Matrix must be ordered with **two** composite video modules. Use one for Luminance (Y) and the other for Chroma (C). The Y and C signal lines are then connected to the two video modules. See illustration on facing page.

When connecting Y and C cables, be sure to use the same input numbers on the two video modules for each source. This example uses number 1 inputs. Also, use the same output number pair for each destination. This example uses number 1 outputs, but we could have used outputs number 2, or 3, etc.

Input Connections

Choose which input number to use to connect the S-Video source device to the Matrix 200. Connect the Luminance (Y) to the input connector on the first (left) Video module and the Chroma (C) to the same input number on the second (right) Video module.

If audio is used, connect the right and left audio source outputs to the right and left inputs on the back of the Matrix. See page 3-9 for details on audio connections.

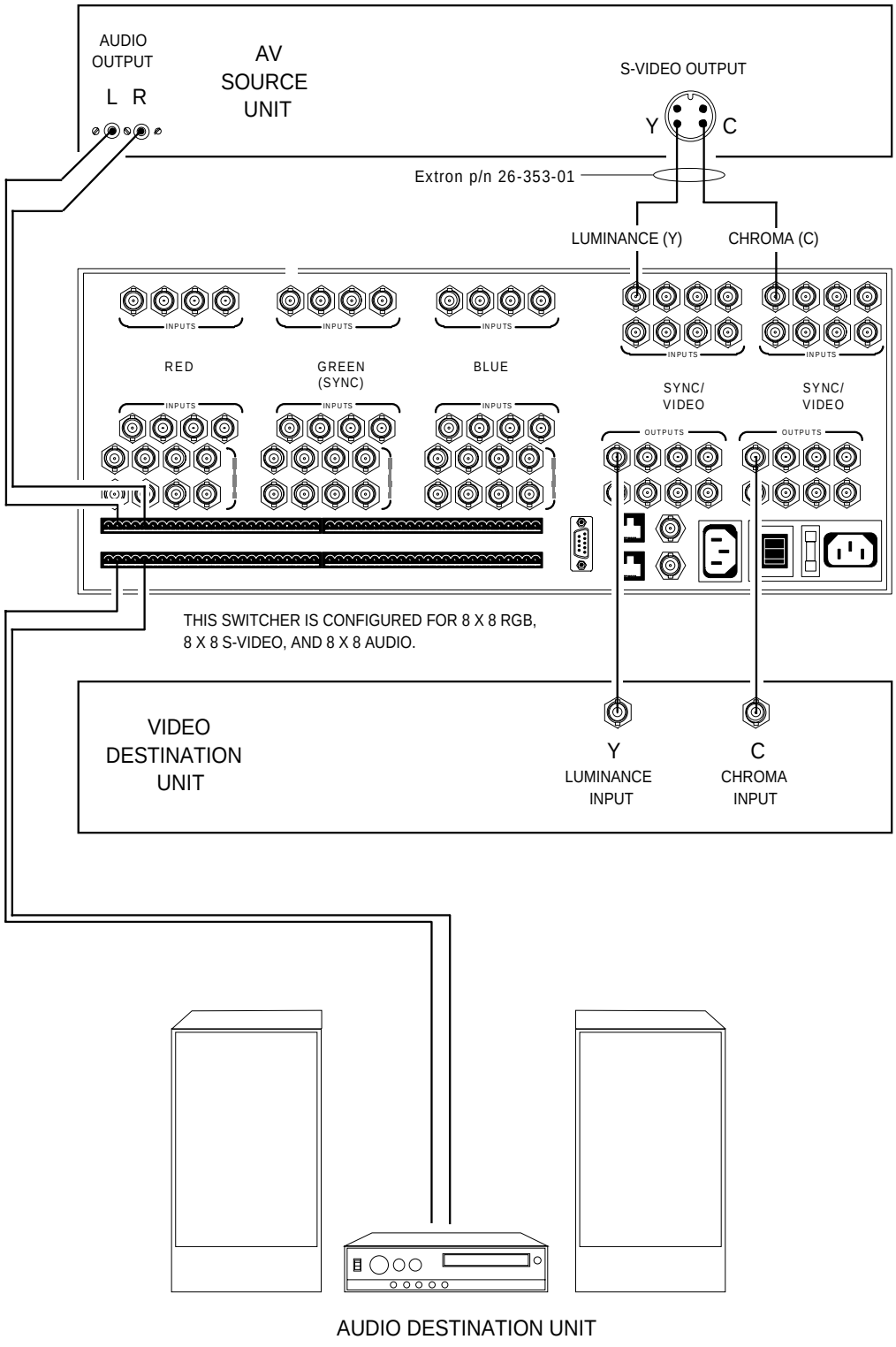
Output Connections

Choose which Matrix 200 output number to use for the S-Video destination unit. Connect the Luminance (Y) output from the first (left) Video module to the Luminance input of the destination unit. Connect the Chroma (C) from the same output number on the second (right) Video module to the Chroma input of the Video destination unit.

If audio is used, connect the right and left audio output from the Matrix connector to the right and left inputs of the audio destination unit. See page 3-9 for details on audio connections.

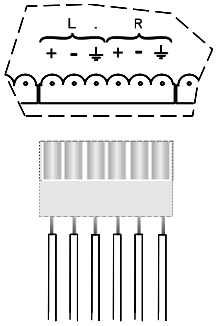
A Matrix 200 can be configured with RGsB (sync on green) and S-Video.

S-Video Input Connections with Right & Left Audio



Audio Connections may or may not be used. See page 3-9 for wiring.

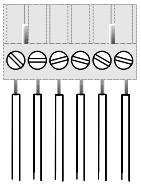
Audio Terminal Connections



The rear of the Matrix 200 has two rows (16 sets) of audio connector pins below the BNC connectors. The top row is for 8 inputs and the bottom row for 8 outputs. Each group of six pins accommodates a left and a right audio channel. One sample is shown here.

The 6-terminal screw (Phoenix®) connectors are supplied with the switcher. The connectors are wired to the audio cables using the captive screws inside the connectors. The connectors are then plugged into the appropriate position in the audio terminal strip on the rear panel. The audio area of the back panel is labeled “R” (right) and “L” (left) for each channel.

When wiring the connectors and inserting them into the Matrix 200 switcher, the screw heads (see picture right) must face **down**.

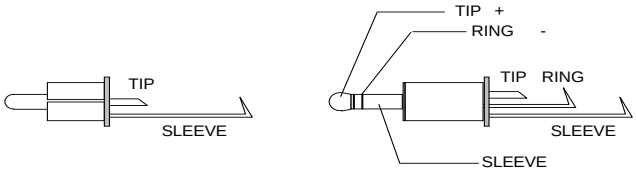


Audio Wiring Applications

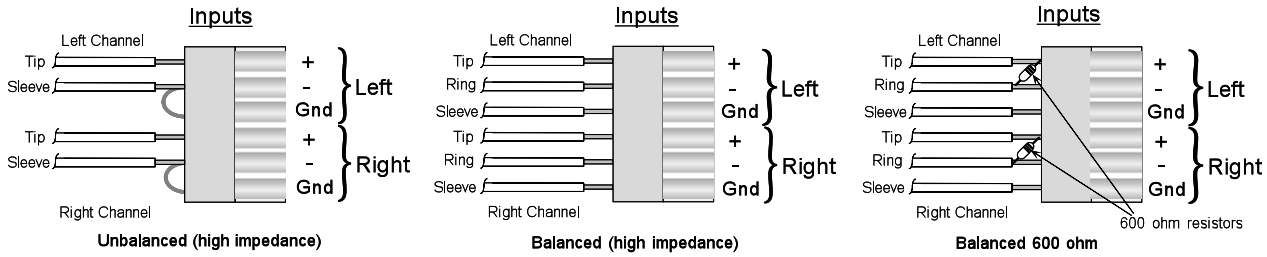
Three methods of wiring the connectors for input and output are listed here and illustrated below. The connector screws do not show in the picture because they are on the other side.

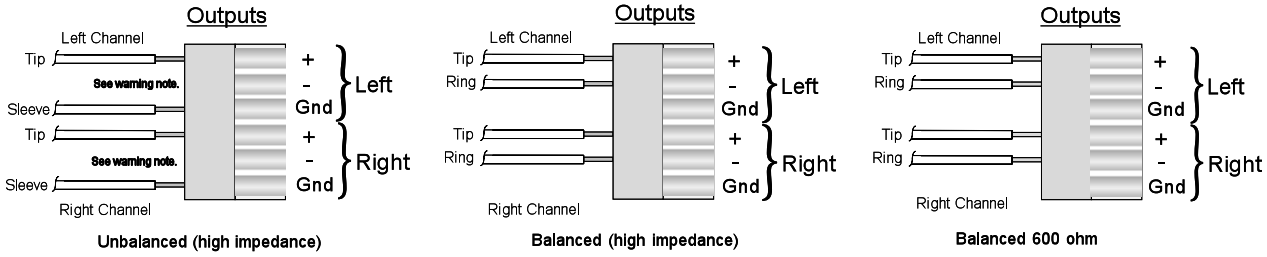
- *Unbalanced High Impedance (High Z) Stereo Tip, Ring, Ground (Left & Right)*
- *Balanced High Impedance (High Z) Stereo Tip, Ring (Left & Right)*
- *Balanced 600 ohms input Impedance Stereo Tip, Ring (Left & Right)*

The audio cable equivalent connections are shown here.



If using unbalanced audio output, use the lower-left connector as an example and connect the sleeve to Gnd. Connecting it to the negative (-) terminal will damage audio output circuits.



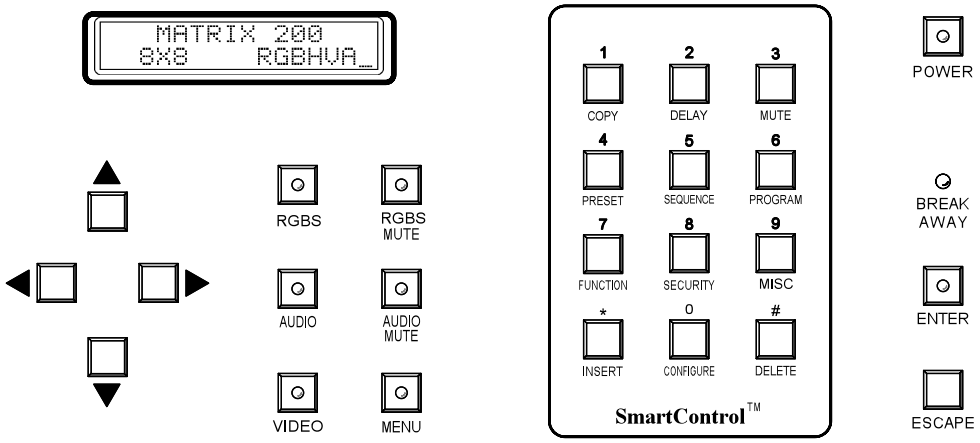


Use Phoenix® audio connectors, Extron part number 10-163-01

Chapter Four

Using the Front Panel Controller

Front Panel Controller (FPC) Operation

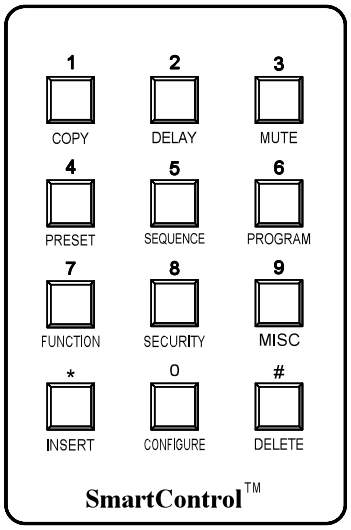


Control/Indicator	Function
LCD display	The Liquid Crystal Display (LCD) has two-rows and 16-columns of character positions. It displays the Matrix status, as well as menus used to configure the unit.
Cursor keys	Press Left/Right keys to step to the next accessible position. (Cursor skips over positions that cannot be accessed.) Press Up/Down keys to step through choices.
RGBS key/light (*)	Press to select all RGB and Sync modules as a Gang. The light is on when the mode is selected. Press again to deselect.
Audio key/light (*)	Press to select audio connections. Left and right audio channels cannot be separated. Light is on when the mode is selected. Press again to deselect.
Video key/light (*)	Press to select all video connections as a Gang. This could be Composite Video or S-Video. Light is on when selected. Press again to deselect.
	(*) Pressing any combination of these three keys will put them together as a "Group"; pressing a key again will remove that Gang from the Group.
RGBS Mute key/light	Press to mute all RGB and Sync outputs. Light is on when muted. Press again to restore muted outputs.
Audio Mute key/light	Press to mute all audio outputs. Light is on to indicate mute mode selected. Press again to restore audio outputs.
Menu key/light	Press for Selection Menu, from which other menu selections can be made. The last menu selected will be "remembered" the next time this key is pressed.
Keypad	Dual function 12-key pad (0-9, #, *) is used to enter numeric data into SmartControl™ configuration memory as well as to select menus (next page).
Power key/light	Press to turn power on; press again to turn it off. Light is on when power is on.
Break Away LED	When lit, the information displayed in the LCD does not represent a group or a gang, but an individual plane or all planes in a group that are not tied together.

Enter key/light — Press to accept or store the current display changes. The light blinks when pressed.

Escape key — Press to cancel current operation or to return to default (TIE) menu.

Selecting Menus Using the SmartControl™ Keypad



First press **Menu**, and then press one of the following:

[Escape] to select the default Tie (Connection) Menu

[1] to select Copy menu. (copy a configuration)
[2] to select RGB Sync Delay menu.
[3] to select Mute menu.

[4] to select Preset menu. (save/load a preset)
[5] to select Sequence menu.
[6] to select Program menu.

[7] to select Function menu.
[8] to select Security menu.
[9] to select Miscellaneous menu.

[0] to select the Configure Audio menu

The Matrix 200 has 10 user-selectable menus, each of which is discussed separately in the paragraphs that follow.

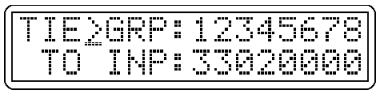
Power On Message

Press the Power key to apply power to the Matrix 200. The following identification message will display for five seconds. SmartControl detects the I/O module configuration and displays the information. Letters on the second line of the display show what type of switchers or planes are installed in the six (6) available Matrix 200 positions.

The example here indicates the following configuration:

R -Plane 1 has an HRAM module for Red
G -Plane 2 has an HRAM module for Green
B -Plane 3 has an HRAM module for Blue
H -Plane 4 has a Sync module for Horizontal
V -Plane 5 has a Sync module for Vertical
A -Plane 6 has an Audio module
_ -Plane 7 is always empty
other possibilities include:
C -Composite Video module (Plane 4 and/or 5)
S -One Sync module detected, indicating composite H/V (Plane 4)

After five seconds, the LCD will display one of three Tie Menus. This menu, called the “default menu”, displays input/output. It is explained later in this chapter.

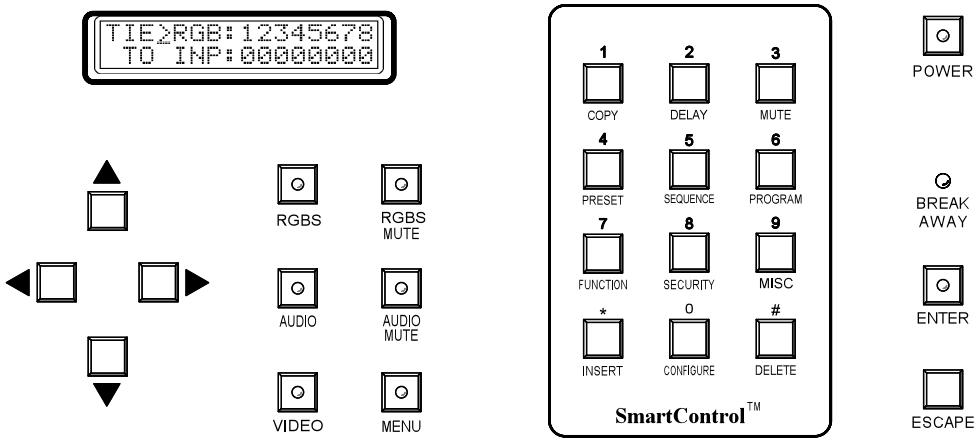


The example here shows a Group with input #3 Tied to outputs #1 and #2. Input #2 is Tied to output # 4. Details follow.

The plane number refers to the physical address of the I/O module.

Tie Menu (default menu)

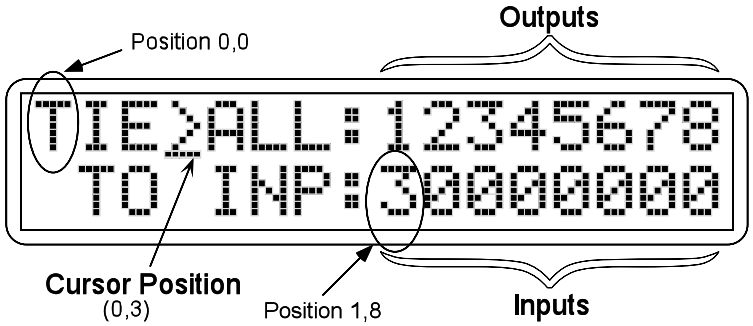
The Tie Menu is the default menu for the Matrix 200. Used to make all input/ output connections, this menu has four submenus (Tie levels): Tie Gang, Tie All, Tie Group, and the Tie Individual Menus. See examples on the next page.



How to select the Default Menu. This menu is displayed automatically (immediately after the Power On message) when the Matrix 200 is powered on. The Default menu may be selected at any time during normal operation by pressing **Escape**.

Using the LCD Display

In the illustration below, the numbers 1 thru 8 in the top row are fixed output numbers. The space below each output position will contain the number of the input to be tied (connected) to that output. These numbers can vary from 1 through 8, depending on how the Matrix 200 is configured. The example here shows input #3 tied to output #1 with no inputs tied to the other seven outputs.



Throughout this section, references are made to the positions in the LCD display:

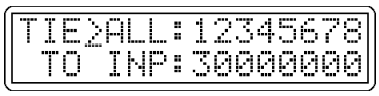
- *The top row is zero (0), and the bottom row is one (1).*
- *The left-most position is zero (0), and the right-most is 15.*

The picture above shows some position numbers. For example, the upper left position is 0,0. The cursor (indicated by the underline character "_") is at 0,3.

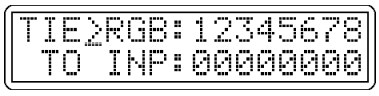
The symbol > is used in many of the Matrix 200 menus as a cursor point from which the function to the right may be changed.

How I/O Modules Are Handled

Each Matrix 200 is custom designed, therefore, there could be different combinations of I/O modules consisting of RGB, Sync, Video and/or Audio modules. Each I/O module occupies a separate plane and can be handled in any of four ways. The LCD displays below show four examples of submenu Tie Levels. These will be explained in detail later in this chapter.

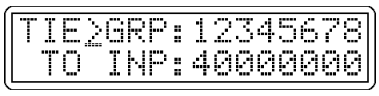


1. The first Tie Level ties “All” modules together. This includes each I/O module, regardless of any other Gang or Group assignment.

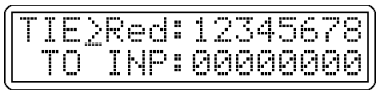


2. The second Tie Level display shows RGB, however, if the Matrix has Sync modules, they are included. The Matrix 200 recognizes the I/O modules installed and automatically “Gangs” associated modules together. There are three categories for ganging and these are related to the three front panel keys shown below.

- *The RGBS Gang includes all HRAM and Sync modules installed. (RGB, RGBS or RGBHV)*
- *The Audio Gang is the stereo Audio module. (Left and right channels cannot be separated.)*
- *The Video Gang includes all Video modules. (Composite or S-Video)*



3. Another way is to combine any of the three Gangs (previously mentioned). When TIE>RGB appears in the display, pressing combinations of these three keys will put them together as a Group, and the display changes to TIE>GRP.



4. Any I/O module can be handled separately. This is called “Individual” or “Breakaway” mode. A typical Tie Individual Submenu is shown here. For a Matrix with RGBS, Composite Video and Audio, other selections include: Grn, Blu, Syn, Cv2 and Aud.

_____ *Some Useful Terms*

Matrix Switching *– Matrix switching differs from ordinary switching in that instead of one input being tied (connected) one output, an input can be tied to more than one output at the same time.*

Tie *– A connection between an Input and an Output.*

Set of Ties *– Connections between one Input and more than one Output.*

Configuration *– Any Tie, Set of Ties, or Sets of Ties between Input(s) and Output(s).*

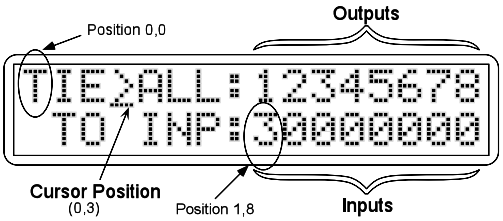
Active Configuration *– The configuration that is currently being used by the Matrix 200 .*

Preset *– A configuration that has been stored and can be recalled and used again.*

Changing Tie Submenus

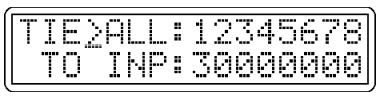
Many of the menus have submenus. To change Tie level, use the Left/Right cursor keys to place the cursor at (0,3) under the >. Use the Up/Down cursor keys to display the desired level.

The choices that appear will depend on how the Matrix is configured. For example, if a Matrix has RGBS, Composite Video and Audio, the Tie Menu choices will be: ALL, RGB, Red, Grn, Blu, Syn, Cv2 and Aud.



The cursor is a blinking line under the position where changes can be made. The Left/Right cursor movement steps only to those positions that can be accessed.

Tie All Level

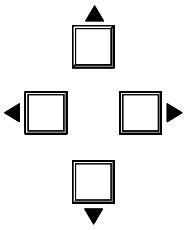


In the Tie All menu, connections to all I/O ports (RGB, VID, and AUD) are made simultaneously.

1. If not presently in the (default) Tie Menu, press the **Escape** key. Observe that the cursor is at the 0,3 position, as in the figure above.

2. If not already displayed, use the Up/Down cursor control keys until the word "ALL" is displayed to the right of the cursor.

A blinking period (".") in any position of the lower row of the LCD display indicates that this output connection is different on each plane (Breakaway).



3. Use the Left/Right cursor keys to move the cursor under the first input/output connection to be connected. For example, to connect input 3 to output 1, place the cursor under the "0" in the bottom row, under output #1 (position 1,8).

4. With the cursor positioned under the input/output position, do either one of the following:

Use the Up/Down cursor keys to step to "3",

or

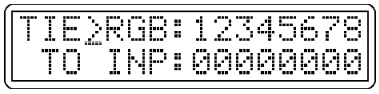
Press the "3" key on the numeric keypad.

Observe that the "3" in the bottom row is blinking to signify a "tentative" connection, meaning that the connection has not yet been stored in memory. (See menu at top of page.)

5. Move the cursor under the next input/output connection to be made and enter the desired input number. Continue doing this until all tentative input/output connections have been made. Observe that all input/output connections to be changed are now blinking. (Those that are not to be changed will not blink.)

6. Press **Enter** to store the input/output connections into memory.

Tie Group Level



The Matrix 200 has three I/O Gangs: RGBS, Video and Audio. The Tie Group Level allows one or more Gangs to be configured as a Group. On the FPC, each of these three Gangs has a button. In the LCD display, the Gang names are abbreviated as: RGB, VID, and AUD. Use the steps below to set up a group.

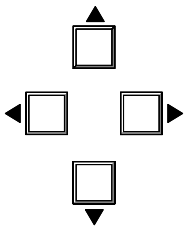
For this example, combine RGB with Audio and set them up as a Group.

1. Press **Escape** to display the default Tie Menu (if not already displayed). Observe that the cursor is at the 0,3 position.

2. If necessary, use the Up/Down cursor control keys to display “RGB” to the right of the cursor (as pictured above). RGB is a group by itself, but, for this example, add Audio.

3. On the FPC, press RGBS, and then AUDIO. Observe that the LED indicators at the center of both the RGB and AUDIO buttons are lit, indicating that the corresponding functions have been selected.

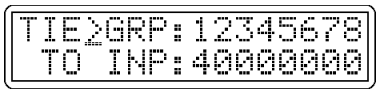
*If the Matrix is not configured for a particular function (for example, no Audio), the LED in the center of the button will **not** light.*



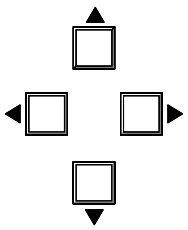
4. The LCD display should now show GRP, instead of RGB. This means that more than one Gang has been selected. See figure below. For this example, connect input 4 (consisting of RGB and Audio) to output 1.

5. Use the Left/Right keys to position the cursor under the first input/output connection to be switched. In this example, under the “0” below output #1.

6. Move the cursor to the first input/output position (INP #1). Use the Up/Down cursor keys to step to “4” in the lower row. (Or press the “4” key on the numeric keypad.) See picture.



Observe that the “4” is blinking to signify a “tentative” connection. That is, the connection has not yet been stored in memory.



7. Move the cursor to the next input/output connection to be made and enter the desired input number. Continue until all input/output selections have been made. Observe that all input/output connections to be changed should now be blinking to show tentative connections (the changes have not yet been stored). Those positions that have not been altered will not blink.

8. When all input/output connections have been made, press **Enter** to store the input/output connection settings.

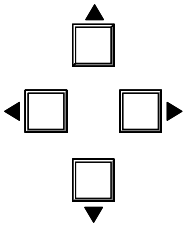
Tie Individual Level (Breakaway)

With this menu, connections are made separately to each of the I/O ports. For this example, connect Red input #5 to outputs #1 and #3. The actual display information may vary, depending on the Matrix configuration.

```
TIE>Red:12345678
 TO INP:00000000
```

1. If not already in the default Tie Menu, select it by pressing **Escape**. Observe that the cursor is at the 0,3 position (under the >).

2. Use the Up/Down cursor keys to step through the choices. (e.g. Red, Grn, Blu, Syn/Cv1, Cv2, Au1, etc.). Stop when your choice (Red for this example) appears.



3. Use the Left/Right keys to position the cursor under the first input/output position to be connected (INP #1).

4. With the cursor positioned under INP position #1, use the Up/Down cursor keys to step to “5”, or press the “5” key on the numeric keypad. Observe that the “5” in the bottom row is blinking to signify a “tentative” connection, meaning it has not yet been stored in memory.

5. Continue by moving the cursor under the next input/output connection to be made (INP position #3) and enter the input number (5). Repeat this step for each connection to be made. Observe that all INP positions that have tentative changes are now blinking. (Those input/output connections that are not to be changed will not blink.)

```
TIE>Red:12345678
 TO INP:50500000
```

6. When all input/output connections have been entered, use the Left/Right cursor keys to move the cursor at position 0,3. Press **Enter** to store the input/output connection settings in memory.

At this point, the Breakaway indicator will light to indicate that the connections were made on an Individual plane and not on a Gang.

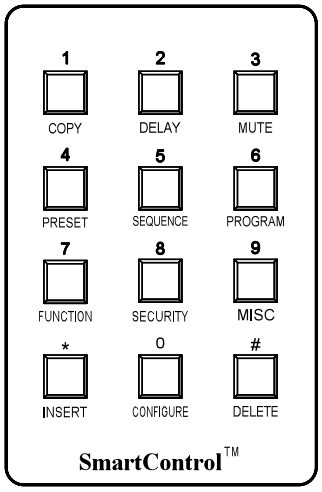
After setting up an individual configuration, it can be copied to other planes. For example, the configuration made for Red can be copied to Green and Blue. This is explained later in this chapter.

Menu Selection

Press the **Menu** key, and observe the LCD display (see picture). This menu allows the user to select the particular menu that pertains to the function to be performed. The LCD displays the menu number and name (1. Copy). Notice that the numeric keypad has the corresponding menu name next to each number key.

```
MENU SELECTION
1.Copy (Unbreak)
```

Notice that the cursor is in the second line, first position (1,0), under the menu number (1). To select this menu, press **Enter**. To select another menu, press the corresponding numeric key. This is the fastest way. When selecting with the keypad, it is **not** necessary to press **Enter**.



Another way to choose a menu is to use the Up/Down buttons to step through the list of menus, and then press **Enter** when the desired menu appears.

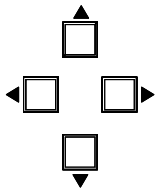
The last menu# used is stored. For example, if menu 3 was used last, the next time the menu button is pressed, menu 3 appears in the display. To select it again, the steps are **Menu**, followed by **Enter**.

e.g. The fastest way to select a menu, when the Matrix 200 is in the default menu, is to press Menu followed by the number key for the desired menu. See keypad picture.

Using the Copy Menu (1)

This menu is used to copy settings from one Plane, or module, to another. This is especially useful when the system is completely broken away, since it eliminates the need to set up different Planes with similar programs. For example, after doing a "Tie Individual" for the Red Plane, as described earlier in this chapter, that program for the Red Plane can now be copied to the Green and Blue Planes, etc. This eliminates having to do the same program more than once.

Making Changes



1. Copy from - Use Left/Right keys to move the cursor at position 0,5 (under the > in the top line). Use Up/Down keys to step through available Planes (I/O modules) until the desired source name is displayed. The example shows Red.

2. Copy to - Use the Left/Right keys to move the cursor to position 1,6 (under the > in the bottom line). Use Up/Down keys to step through the available Planes until the destination (copy to) name is displayed. The example shows Grn.

3. Press **Enter** to accept the copy source and destination, and execute the copy.

4. Repeat steps 1 thru 3 for any other modules you wish to copy. For example, copy the Red Plane to Green Plane, and then to the Blue Plane, etc.

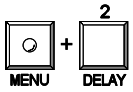
5. Press **Escape** to return to the default menu.

Using the RGB Sync Delay Menu (2)

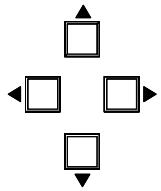
This menu programs the Matrix 200 for "glitch-free" switching of Sync and RGB signals by establishing a fixed time delay between them. A time delay can be set for each output. When switching takes place, the Sync connects to the output right away, but the RGB signals connect after the time delay. This means the projector is already in sync when the picture arrives. The sync delay range is from 0 to 9.9 seconds, in increments of 0.1 seconds.

To select this menu, press **Menu**, followed by "2", or use the Menu Selection procedure on page 4-6.

The "1" shown in the picture will be the number 1 to 8 of the output sync to be affected, (this number is 1 to 4 for 4 x 4 or 8 x 4 switchers) or "All" to delay switching all outputs by the same amount.



1. With the Delay RGB->Sync menu displayed, the cursor should be at 1,0. Use the Up/Down cursor keys to select All, Out1, Out2, etc., for a specific output.

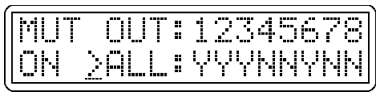


2. Use the cursor keys to position the cursor at position 1,11. Use the Up/Down cursor keys to sequence through the available delay times in increments of 1 second (0 thru 9) until the desired delay time is displayed.
(If required, step to position 1,13 and set a value for "tenths" of a second.)

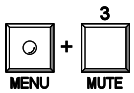
3. Press **Enter** to store the sync delay value.

4. Press **Menu** to continue setup, or press **Escape** to return to the default menu.

Mute Output Menu (3)

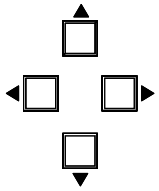


This menu allows selective muting of individual outputs from the Matrix 200. There are three choices for muting selective outputs: RGB, AUD and ALL, where ALL includes RGB and AUD. If the Matrix does not have audio, that will not display as a choice.



To select the Mute Menu, press **Menu**, followed by "3" on the numeric pad.

To change the Mute Output Settings, do the following:



1. With the Mute menu displayed, and the cursor under the >, use the Up/Down keys to select the function to be changed (RGB, AUD or ALL).

2. Use the Right/Left keys to move the cursor to the output to be muted.

3. Use the Up/Down keys to switch between Y (yes) and N (no).
Repeat steps 2 and 3 until all choices have been made.

4. Press **Enter** to save the setup.

5. Press **Escape** to return to default menu.

Automating the Matrix 200

The three stages of automating the Matrix 200 switching are “presets”, “sequences” and “programs”. The three menus that follow are associated with automating:

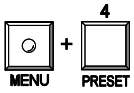
- *Routing configurations may be stored as Presets. (See Menu 4.)*
- *These stored Presets may be assigned as timed steps, to run in a Sequence. (See Menu 5.)*
  A Sequence may be started at any time, and will loop through preset steps until stopped.
- *A Preset, or a Sequence, may also be Programmed to start at a specific time on a specific date. (See Menu 6.)*

Preset Menus (4)

A “Preset” is any routing configuration that has been set up in the Matrix 200 and has been stored for future use. Any time the Matrix 200 has been configured, it may be desirable to save those settings and use them again. Use the “Save Conn. As Preset” menu to save the current routing configuration to SmartControl memory by assigning it a number (1 - 20).

Later, when a Preset (a previously stored configuration) is needed, use the “Load Preset” menu to set the Matrix for those conditions. The sections on Menus 5 and 6 explain how to use these Presets.

Caution: *Saving a preset will overwrite any previous routing information saved under the same preset number.*



To select the Preset Menu, press **Menu**, followed by “4” on the numeric pad.

Load a Previously Saved Preset (menu 4)

1. With the Preset menu displayed, and the cursor under the “P”, use the Up/Down cursor keys to display LOAD on the top row.

2. Use the cursor keys to move the cursor to the lower right corner of the display (position 1,15). Use the keypad to enter the desired preset number (1 - 20).

3. Press **Enter** to load that preset number. If there is nothing stored in the preset location requested, a display of “Invalid Preset” will appear.

4. Press **Escape** to return to the default menu.

Hint 1: Make a list of all routing connections that have been saved as presets. List them by preset number with a description to ensure that the correct preset is selected for each application.

Hint 2: Before making a completely new preset configuration, load one that closely fits your new requirements. Modify it, and save it under a new preset number.

Save the Current Routing as a Preset (menu 4)

1. With the Preset menu displayed and the cursor under the “P”, use the Up/Down cursor keys to display the SAVE menu, as shown here. The Preset number should be blinking.

2. Use the cursor keys to move the cursor to the lower right corner of the display (last position 1,15). Use the keypad to enter the preset number (1 - 20).

3. Press **Enter** to store the current routing configuration to memory.

4. Press **Escape** to return to default menu.

The following menus (5 and 6) explain how use the Presets to automate the Matrix 200.

Sequence Menu (5)

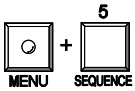
Creating a Sequence is the second step in automating the Matrix 200. Menu 4 was used to save preset configurations. Menu 5, called “Sequence menu”, uses those presets to automate applications for the Matrix 200.

A timing sequence can be written to have up to 31 steps. Each step loads a preset configuration (created by Menu 4) to be active for a specific period of time. At the end of that time period, another preset loads a configuration for another time period, etc. Without intervention, a sequence will loop. That is, after the last step of a sequence ends (times out), the first step begins and the sequence repeats until stopped. The Matrix 200 can store up to 31 separate sequences; each sequence can consist of up to 31 steps.

There are three sequencing submenus:

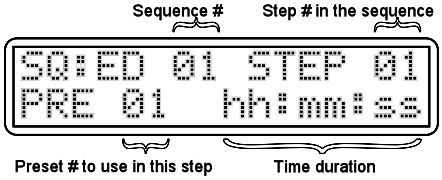
- *Edit (ED) Submenu*
- *Copy Submenu*
- *Operation Submenu*

The Operation Submenu is divided into four functions to manually control the sequence. These are: Start, Stop, Resume, and Delete.



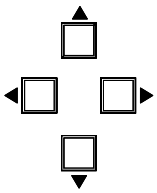
To select the Sequence Menu, press **Menu**, followed by “5” on the numeric pad.

Create a Timing Sequence (menu 5)



1. To create a timing sequence, place the cursor at the upper left corner of the LCD display (position 0,0), then use the Up/Down keys to select the Edit (ED) Submenu, shown here. Observe that the first step of the sequence (01) is displayed at the far right end of the top row.

2. Move the cursor to position 1,5 and enter the preset number (1-20) to be used in this step of the sequence. (Only saved presets may be used.)



3. Move the cursor to the appropriate time digits (shown as hh:mm:ss) and enter the time duration for this sequence step. (Use the 24-hour clock.) Numbers can be entered directly from the keypad or by scrolling with the Up/Down keys.

The maximum time duration is 16:59:59.

4. Move the cursor to the top, right position (0,15) and change the number (Up key) for the next step in the sequence. Repeat 2 and 3 to set the preset number (1-20) and the time duration for the next step of this sequence. Repeat this for each step in the sequence.

5. Repeat 2 thru 4, above, until all steps of the sequence have been set.

6. When finished, press **Enter** to store the sequence**.**

Edit a Timing Sequence (menu 5)

To edit a sequence, place the cursor at position 0,7 and enter the number of the sequence to be edited. Repeat steps 2 - 6 (above) to make changes until the sequence is correct.

To **delete** a step (for example, delete step 03) from a sequence, load the sequence and scroll to the step to be deleted (03). Press Delete (the # key). The steps that followed step 03 will move forward. Step 04 now becomes Step 03, etc.

To **insert** a new step in a sequence, display the SQ:ED menu, shown above. For this example, we will insert a new step before step 4, of sequence 2. The new step will use preset 6 for a duration of 12 minutes.

1. Choose the number of the sequence to be altered (02).

2. Use the cursor keys to display the number of the step where the **new** step will be inserted (04).

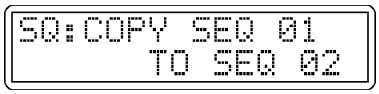
3. Press **Insert** (the * key).

4. Move the cursor to position 1,4/5 and enter the preset number to be used (06).

5. Move the cursor to the minutes position (mm) and enter the time (12).

6. When finished, press **Enter** to store the new step.

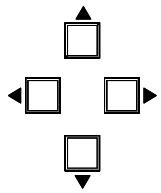
Copying a Sequence (menu 5)



When creating a new sequence, it may be easier to make a copy of an existing sequence and then edit the copy. The new, edited copy will be assigned a new sequence number. To make a copy of an existing sequence, do the following:

1. With the cursor at the upper left corner of the LCD display (position 0,0), use the Up/Down keys to select the Copy Submenu. Observe that sequence "01" is displayed in the top row, and a "To" sequence number is in the lower right.

This example copies Seq 01 to Seq 02.



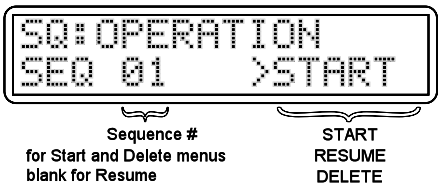
2. To change either of these sequence numbers, use the Left/Right keys to step to the location of the number(s) to be changed.

3. At the top-right, enter the number (01-32) of the sequence to copy using the keys of the numeric keypad.

4. Move the cursor to the bottom row of the LCD display (positions 1,13-14) and enter the sequence number (1-32) assigned to the new copy.

5. Press **Enter** to make the copy.

The two sequences (01 & 02) are now identical. Use the Sequence Edit menu to make changes to the new sequence.



Start a Sequence (menu 5)

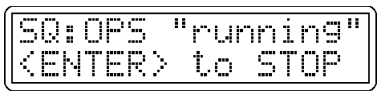
1. To start a sequence, place the cursor at the upper left corner of the LCD display (position 0,0). Use the Up/Down keys to select the Operation Submenu. (See picture.)

2. With the cursor at the 1,9 position, use the Up/Down cursor keys to scroll through the menu choices until "START" appears in the LCD display.

3. Use the Left/Right keys to step the cursor to the SEQ position and enter the number of the sequence to be started.

4. Press **Enter** to start the sequence.

The sequence will continue running in a loop (repeat) until it is stopped. The Start Menu is replaced by a Stop Menu. Only one sequence can run at a time.



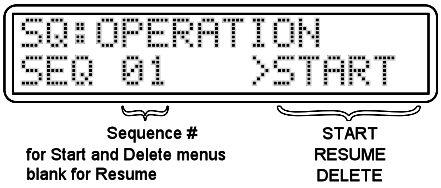
Stop the Sequence (menu 5)

When a sequence is running, the "Enter To Stop" menu (left) appears in place of the Operation Menu. Press **Enter** to stop the sequence that is running. The Stop Menu is now replaced by the Operation Start menu.

Resume the Sequence (menu 5)

After a sequence has been stopped, SmartControl remembers which sequence was running. To resume the stopped sequence, select the Operation Submenu and place the cursor under the >. Use the Up/Down keys to display “Resume”. Press **Enter** to resume running the sequence that was stopped. There is no sequence number required; it can only resume the sequence that was last running.

Delete a Sequence (menu 5)



1. To delete a sequence, place the cursor at the upper left hand corner of the LCD display (position 0,0), then use the Up/Down keys to select the Operation Submenu, see picture.

2. With the cursor at the 1,9 position, use the Up/Down cursor keys to scroll through the menu choices until “DELETE” is displayed (where Start is shown in the picture).

3. Move the cursor to the SEQ position and enter the number of the sequence to be deleted.

4. Press **Enter** to delete the sequence.

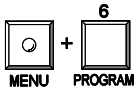
Program Menus (6)

The Program Menus are the third step in automating the Matrix 200. (Previous menus, 1-5, must be used to prepare for the use of this menu.) This feature is especially convenient for video post-production and program distribution where full switching automation is desired.

In the Matrix 200, a Program uses the built-in clock and calendar to load a ready-made Sequence (see menu 5) or a Preset (see menu 4) at a specific date and time.

Only one program can exist at one time.

For example, Sequence 02 may consist of the following steps:
Step 01, load preset 1 to run for 10 minutes.
Step 02, load preset 5 to run for 25 minutes.
Step 03, load preset 7 for 45 minutes.
When a Sequence is loaded, it will loop (repeat) until it is stopped.



To select the Program (PG) menu press **Menu**, followed by “6”. Observe that the Program menu is displayed. The three Program menus are described on the following page.

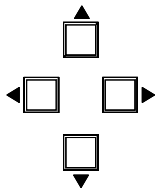
In the following example, program the Matrix 200 to load Sequence 02 on 31 October, 1997 (31/10/97), at 3:15 p.m. (15:15:00).

1. Both date and time must be set for a program to run; neither entry can be skipped.
2. Using an old date will give an invalid date error.

Program Start Time/Date (menu 6)

The Program menu to the left has 7 selection points. Use the Left/Right cursor keys to step from one to another. Three selection points are indicated by the character ">". These are used to define the type of Program menu. The other four selection points are for entering data.

1. To program a sequence (or a preset) start date/time, place the cursor at position 0,2 (PG>)and use the Up/Down keys to select the Start Day menu shown here.



2. Press the Right cursor key to step the cursor to the 0,9 position. Use the Up/Down cursor keys to select which is to be programmed: SEQ (Sequence) or PRE (Preset).

3. Press the Right key again to step to position 0,13 and use the Up/Down keys to select the desired Preset (or Sequence) number. (Where picture shows 01.)

4. Step the cursor to position 1,2, and use the Up/Down keys to select "DAY".

5. Use the Left/Right buttons to move the cursor through the positions to be changed (1,8 - 1,15). Use the numeric keypad to enter the numbers for the day (dy), month (mo), and year (yr) for the desired start date. For example, 31 October, 1997 should become 31/10/97.

6. Repeat the above steps 3 and 4. This time select the "TIME" menu, and enter the start time at positions 1,8 - 1,15. Use the keypad keys to enter hour (hh), minute (mm), and second (ss) for the desired start time. For example, 3:15 p.m. is 15:15:00.

When entering a 2-digit number from the keypad, it is not necessary to move the cursor for each digit. The SmartControl enters the first number in the left position and the second number to the right. For example, to enter 15 minutes, put the cursor at "mm" and press "1", and then "5".

7. Press **Enter** to store the program.

Program Delete (menu 6)

There can be only one program in the Matrix 200 at one time. To delete the program, move the cursor at position 0,2 in the Program Menu and use the Up/Down keys to display the Delete Menu. See illustration at left.

Press **Enter** to delete the program.

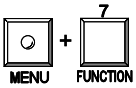
Function Menu (7)

This menu provides access to different operational functions of the Matrix 200. It has three submenus:

LED/LCD Contrast Submenu.

Tie Level Access Submenu.

Vertical Interval Switching Submenu.

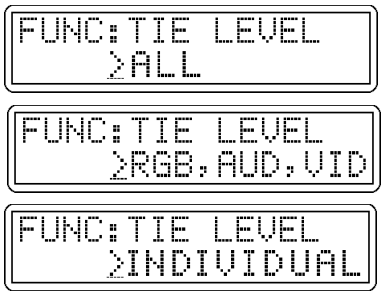


To select this menu, press Menu, followed by "7".

Selecting Function Submenus

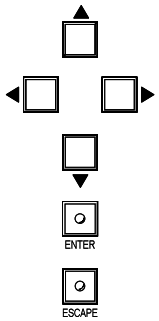
With the Function Menu displayed, use the cursor keys to position the cursor at position 0,0. Use the Up/Down cursor keys to sequence through the three submenus (LCD/LED CTL, VERT INT, TIE LEVEL) until the desired submenu is displayed.

Tie Level Access Submenu (menu 7)



This submenu determines the state transitions in the Tie Menu. There are three choices:

- *The "ALL" level affects connections at all switching levels (planes).*
- *The "RGB, AUD, VID" level affects connections only for the predefined "gangs" of switching levels (planes). These gangs are related to the three keys on the Front Panel.*
- *The "INDIVIDUAL" level permits independent changes to each level (plane).*

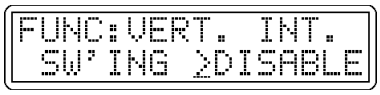


1. With the Tie Level Submenu displayed, and the cursor at position 1,4, use the Up/Down cursor keys to sequence between the three tie levels (ALL, RGB, AUD, VID or INDIVIDUAL) until the desired tie level is displayed.

2. Press the **Enter** key to save tie level to SmartControl memory.

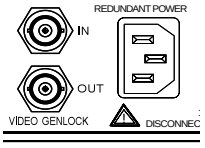
3. Press the **Escape** key to return to the default menu.

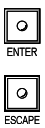
Vertical Interval Switching Submenu (menu 7)



This menu allows the Vertical Interval switching to be enabled or disabled. When **Enabled**, Matrix switching is done using only the vertical sync of the input signal of the Video Genlock connector at the rear of the Matrix 200. (See picture below, right.) When **Disabled**, switching takes place immediately, independent of the Video Genlock signal. If Enabled, and there is no Genlock input, switching will take place after a slight delay.

1. With the Vertical Interval Submenu displayed and the cursor at position 1,8, use the Up/Down cursor keys to toggle between Enable and Disable, and display the desired mode.





2. Press the **Enter** key to save the mode to SmartControl memory.

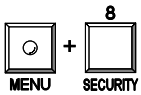
3. Press the **Escape** key to return to default menu.

Security Menu (8)

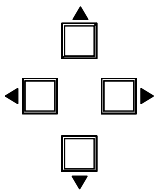
The Security Menu can place certain restrictions on the use of the Matrix 200.

The Executive Mode feature, when set to "ON", will only allow the front panel buttons to be used for viewing the Matrix 200 configuration, although ties can be changed. If it is set to "OFF", the front panel buttons can be used to change the configuration of the Matrix 200.

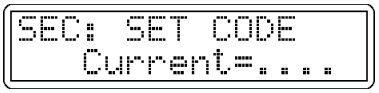
The Security Lockout feature allows the Matrix 200 to be locked, protecting all presets, sequences and programs from being changed. The Lockout feature affects access both from the front panel controller (FPC), as well as from the RS-232/RS-422 interface. (If the code is not known, see page 2-5 to permit access.)



To display the security menu, press **Menu**, followed by the numeric "8" key.



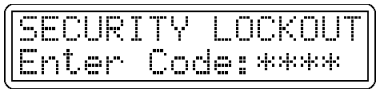
1. To set or change the security code, display the "Sec:Lock-Out Now" menu and use the Up/Down keys to display the Set Code menu (shown here). (Press **Escape** at any time to exit this menu.)



2. Use the cursor keys to step through the four digits and enter the current (....) security code. Use the numeric keypad or the Up/Down cursor keys.

3. Press **Enter**. The menu changes, replacing the word "current" with "new". Use the numeric keypad or the Up/Down keys to enter the new security code.

4. Press **Enter** to store the new code.



To lock the FPC, display the "Sec:Lock-Out Now" menu and press **Enter**. If a security code **has not** been set, the message "code not set" will display. If a code **has** been set, the "Security Lockout" message will display.

Once the Matrix is in this mode, any attempt to access the FPC will show only this message. Access to the Matrix 200 is not allowed, either from the FPC or from the RS-232/RS-422 interface.

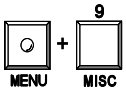
To Unlock the FPC, use the cursor keys to step to the code positions (****) and enter each digit from the numeric keypad. Press **Enter** to unlock the FPC and display the "Sec:Lock-Out Now" menu. Once the Matrix is unlocked, it remains unlocked until it is locked again, either by the FPC (Menu 8) or by the Host system, through the RS-232/RS-422 interface.

Miscellaneous Menu (9)

This menu is used to set the baud rate of the serial communications with the host controller via the RS-232/RS-422 serial port. The menu can also display the software version for the Main Controller and for the FPC. Provision for displaying and setting the internal clock is also provided. The five Miscellaneous Submenus are:

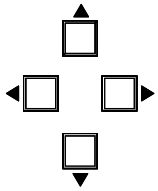
- *Show Local FPC Software Version*
- *Show Main Controller Software Version.*
- *Set Host Baud Rate*
- *Show Time/Date*
- *Set Time/Date*

Descriptions follow.



To select this menu, press **Menu**, followed by "9".

Selecting Submenus



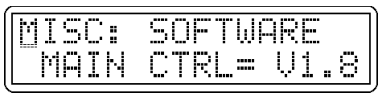
With the Miscellaneous Menu displayed and the cursor at position 0,0, use the Up/Down cursor keys to sequence through the five submenus until the desired submenu is displayed.

Display FPC Software Version Submenu (menu 9)

This submenu is used to display the version number of the FPC software. This is a view-only submenu; no user input is required. With the cursor at position 0,0, use the Up/Down cursor keys to display "LOCAL FPC" on the bottom row of the display. Read software version at positions 1,12 thru 1,15.

Display Main Controller Software Version Submenu (menu 9)

This submenu is used to display the version number of the Main Controller software. This is a view-only submenu; no user input is required. With the cursor at position 0,0, use the Up/Down keys to display the menu shown here. The software version is in the lower-right corner.



The software version numbers for the FPC and the Main Controller board will not necessarily be the same. They are updated separately.

Host Baud Rate Submenu (menu 9)

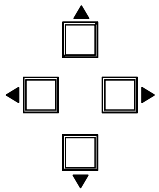
This submenu displays the baud rate of the host controller: 9600 baud. This is a fixed value and cannot be reset.

Show Clock Time & Date (menu 9)

With the cursor at position 0,0, use the Up/Down cursor keys to display "CLK:" on the top row of the display. This submenu is used to display the date and time of the internal clock. This is a view-only submenu; no user input is required. Read clock date and time, as shown here.

Set Clock Time & Date (menu 9)

1. With the cursor at position 0,0 and the Clock Submenu displayed, use the Up/Down cursor keys to display "SET", as shown here.



2. Using the Left/Right cursor keys, position the cursor under the day (da) pair of digits on the top row. Use either the Up/Down cursor keys or the keypad keys to set the current day.

3. Using the Left/Right cursor keys to move the cursor and the Up/Down keys (or keypad keys) to change the numbers, set the current month (mo) and year (yr).

When entering a 2-digit number from the keypad, it is not necessary to move the cursor for each digit. The SmartControl enters the first number in the left position and the second number to the right. For example, to enter 15 minutes, put the cursor at "mm" and press "1", and then "5".

4. Use the same procedure to set the hour (hh), minutes (mm) and seconds (ss).

5. Return the cursor to the 0,0 position. Press the **Enter** key to save the setting to memory.

Configure Audio Menu (0)

The first time power is applied to the audio board, the following conditions exist:

No inputs are connected to outputs.
All inputs are set for professional levels.
All outputs are set for consumer levels.

Refer to the sample display screens on this page. The Configure Audio menu allows audio plane(s) to be configured in the following ways:

Audio1 or 2 = which audio plane is to be configured
Audio plane #2 is not available as of this date.
INP or OUT = configuration is for an input or an output
1 thru 8 = which, of eight inputs or outputs, is to be configured
Lvl = CONSUMER or PROFESSIONAL means the level to be set is for Consumer or Professional audio equipment
(Typical levels: Consumer audio ≈6v p-p; Professional audio ≈30v p-p)

```
CFG:AUDIO1 INP 2
Lvl=P, >LR=+00dB
```

When setting the Input (INP) gain:

>L, R, or LR = which stereo channel (left, right, or both) to be adjusted
+dB or - dB = set to "+" to increase the output level (gain);
set to "-" to decrease the output level (attenuate)
00dB = set the numeric value for dBs of gain (+) or attenuation (-).
The range is -95dB to +31dB.

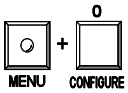
```
CFG:AUDIO1 OUT 1
Lvl=CONSUMER
```

When configuring Output (OUT):

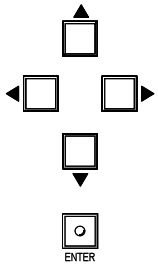
```
CFG:AUDIO1 OUT 1
Lvl=PROFESSIONAL
```

Lvl = CONSUMER or PROFESSIONAL means the level to be set is for Consumer or Professional audio equipment

If using differential (or unbalanced) audio, see Audio Terminal Connections section, page 3-9, to avoid possible damage to audio circuits.



Press **Menu**, followed by "0", to display the Configure Audio Menu.



1. With the cursor at position 0,0 (under C), use the Up/Down keys to select input (INP) or output (OUT) to be changed.

2. Use the Left/Right keys to step the cursor to each function to be changed. (Input and output functions are explained above.)

3. With the cursor positioned, use the Up/Down keys to display choices. (Numeric values can also be entered from the numeric keypad.)

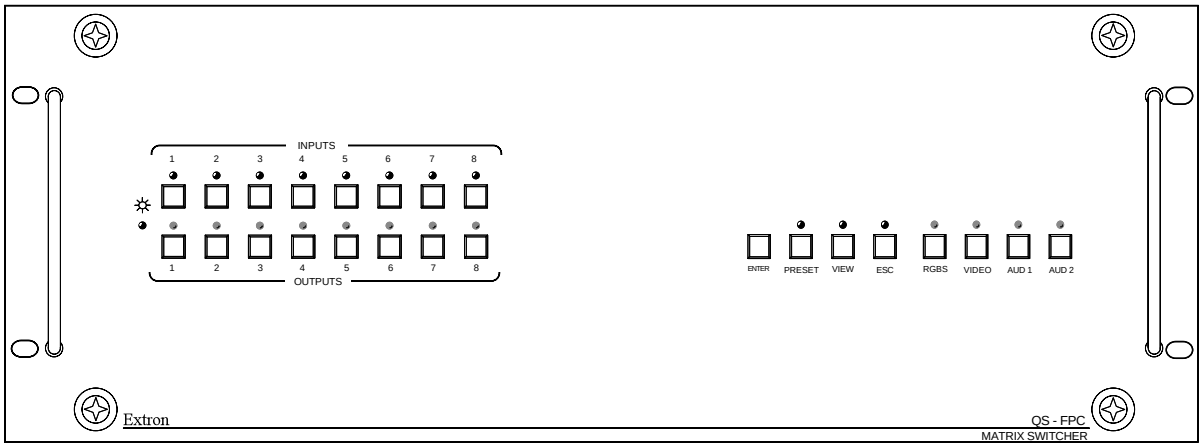
4. When all configuration choices have been made, press **Enter** to store them.

QuickSwitch™ Front Panel Controller (QS-FPC) Operation

The QuickSwitch Front Panel Controller (see below) has its controls arranged in two areas. The left side is Input and Output buttons, and the right side is Control buttons and I/O Module Select buttons.

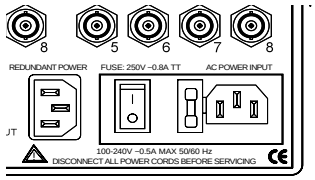
The basic operation of this panel is that it allows the user to tie any one input to one or more outputs. (An output can never be tied to more than one input.) Thus, each input may have a tie (one output), or a "set of ties" (more than one output). At any one time, the active configuration of a Matrix 200 may have a set of ties per each available input. Any configuration (sets of ties) may be stored as a Preset. The maximum number of Presets is eight. The Matrix 200 has Battery Backup; Presets remain saved when power is off.

Because each Matrix 200 is custom-built, it may have different combinations of Input/Output (I/O) modules. For this reason, the operation of your unit will vary to reflect these differences.



Power On Switch and LED

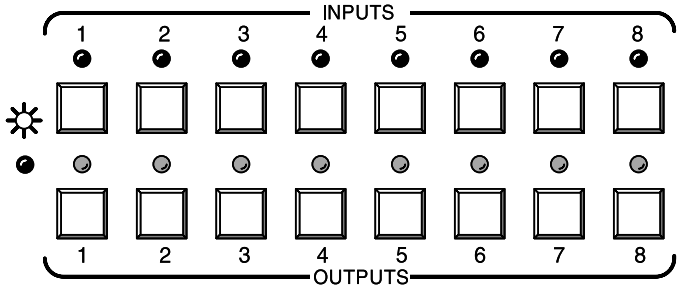
Before using the Matrix 200 front panel, turn power on with the Power Switch on the back of the unit (shown right). The red LED on the left end of the front panel (shown left) lights when power is on.



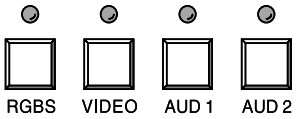
Input and Output Buttons

The panel has a button and an LED for each input and each output. If the matrix is 4x4, only the four left input and output buttons and LEDs will operate. If the matrix is 8x4, all eight input buttons will operate, but only the four left output buttons and LEDs will operate. The best way to describe the Input and Output buttons is to use them in real examples with the other panel buttons. This is done on the pages that follow.

Each input button and LED also refers to a Preset number. Presets are discussed on the next page.



I/O Module Select Buttons



The four buttons on the far right side of the panel are used to select the I/O modules to be viewed or configured. The buttons and LEDs will not operate if the corresponding modules are not installed in your Matrix 200. For example, if your unit does not have audio, the AUD buttons and LEDs will not operate.

When an I/O button is pressed, the associated LED for that I/O module will light to show that it is active. This "active" state remains in effect until that button is pressed again and the LED goes out – or power is removed. These buttons may be used independently or in combinations. For example, if you want to view or configure both RGBS and Audio (audio follow), press RGBS and AUD 1.

RGBS Button – This button selects the I/O modules for Red, Green, Blue and Sync modules to be viewed or configured. Here are some examples:

- *If your unit has RGsB (no separate sync), the RGBS button operates on the Red, Green and Blue signals.*
- *If your unit has RGB with composite sync, the button operates on the Red, Green, Blue and Sync signals.*
- *If your unit has RGBH and V (separate sync), the button operates on the Red, Green, Blue, Horizontal Sync and Vertical signals.*

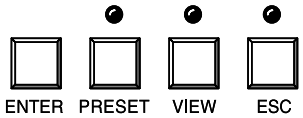
With RGBS active, switching configurations for RGB and Sync may be viewed or set up by pressing Input and Output buttons. See example on the next page.

Video Button – If the matrix has Composite Video, or S-Video, press this button to view or configure those signals.

AUD 1 Button – If the matrix has an audio module, this button allows Audio to be configured or viewed.

AUD 2 Button – This button is reserved for future use.

Control Buttons



Enter Button – This button is used to save changes when setting up a configuration. To set up a configuration, press the desired Input button, press the desired Output button(s), and then press Enter. See examples on next page.

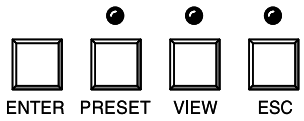
ESC Button – The Escape button is used to end an operation and reset all of panel LEDs for Inputs, Outputs and Controls (active I/O Module LEDs remain on). The ESC button does not reset any configurations that have been entered.

Preset – All current (active) configurations in the Matrix 200 may be stored as a Preset. To do this, press Preset twice (or hold the button for two seconds) and the Preset LED will blink. While the preset LED is blinking, press the Input button for the Preset number to be stored. The LED for that Input will light briefly, and then both the Input LED and the Preset LED will go out. (No output buttons will light.) The Preset has now been stored. There can be one preset for each Input button, for a total of eight – regardless of the number of available inputs or outputs.

The Input buttons and LEDs have two independent functions – as Input numbers and as Preset numbers. When using them to store or load a Preset, this has nothing to do with which inputs are switched to which outputs.

To load a preset that has been stored, press Preset once (briefly). The LED will light steady (**not** blinking). Press the Input button for the desired Preset number. That LED will light briefly, and then both it and the Preset LED will go out.

With Presets stored, the Matrix 200 can be configured again without affecting the stored Presets. This means that there can be eight matrix configurations stored as Presets, and a ninth one active. However, when a Preset is loaded, it destroys the active configuration.



View – Pressing the View button lights its LED for to indicate a "view-only" mode to allow the display of the current Matrix 200 configurations. In this mode, pressing any input or output button will also light all LEDs for the input and output(s) that are part of that configuration. Pressing a button for any unassigned output will light all of the unassigned outputs.

Using the View mode prevents changing configurations by accident.

Page 4-24 has examples of Presets.

Example #1: Configuring the Ties for Input 2.

If necessary, press ESC to clear all Input, Output and Control LEDs.

1. Select I/O modules to be switched. (Example shows RGBS and Audio.)
2. Select the Input number. (Example shows Input 2.)
3. Select the Output(s) to be tied to the chosen Input. The Output LEDs will blink to indicate the tentative changes. (Example shows Outputs 2 and 5.)
4. Press Enter to complete the operation.

If an output had been tied to another input, that tie will be broken in favor of the new one.

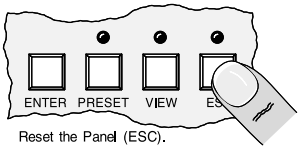
Tie – A connection between an Input and an Output.

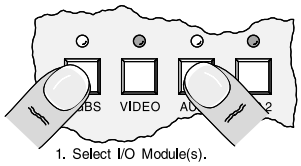
Set of Ties – More than one connection between one Input and more than one Output.

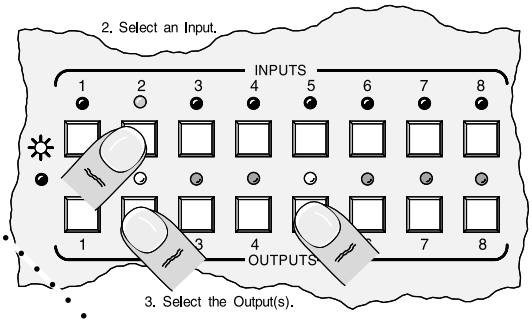
Configuration – Any Tie, Set of Ties, or Sets of Ties between Input(s) and Output(s).

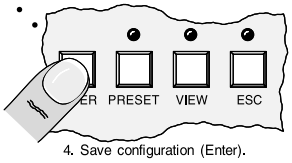
Active Configuration – The configuration that is currently being used by the Matrix 200.

Preset – A configuration that has been stored.





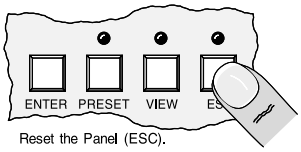


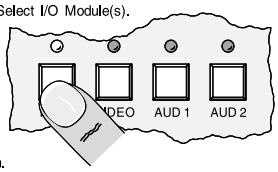


Example #2: Display the Ties for Input 5.

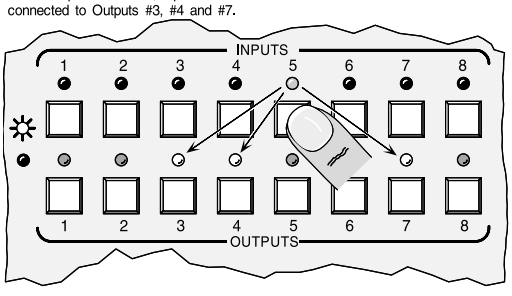
See picture, lower left.

If necessary, press ESC to clear Input, Output and Control LEDs.





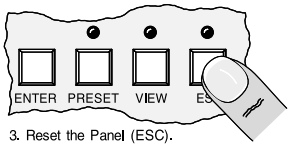
1. Select I/O modules to be switched (example shows RGBS).



2. Select the Input number (example shows Input 5).

The LED(s) for the Outputs (numbers 3, 4 and 7) will light to show that they are connected to Input 5.

If an I/O module LED blinks when displaying ties, it means that the ties for that module are not the same as those for the RGBS module.

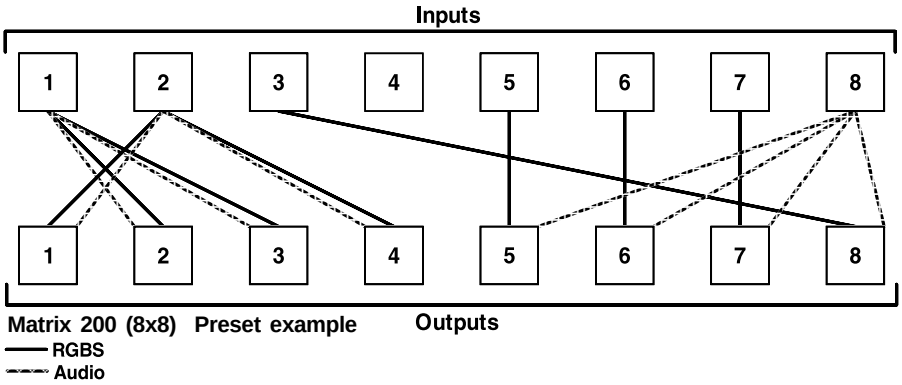


3. Press ESC to clear all Input, Output and Control LEDs.

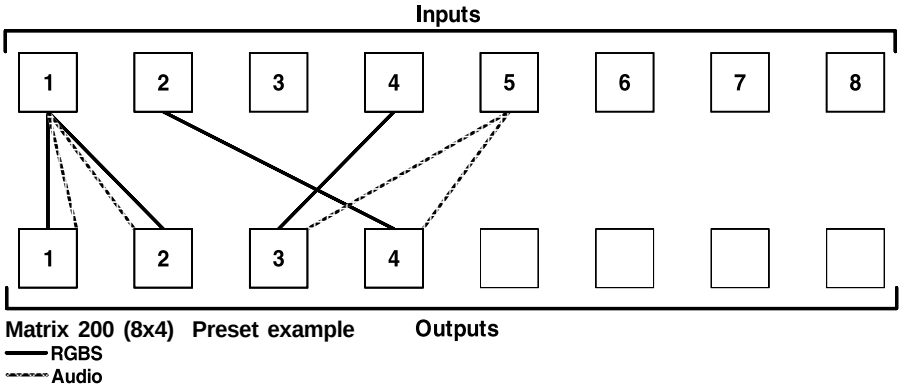
Ties, Configurations and Presets

Only one configuration may be active at one time, and only one Tie (or set of Ties) may be viewed at one time. Therefore, the only way to view each of the stored Presets is to load (activate) each preset and then view each set of Ties in that configuration (as shown in Example #2).

Example #3
This example shows a configuration with seven Ties, or sets of Ties. RGBS and Audio are shown as separate lines.



Example #4
This configuration shows a an 8x4 matrix with four sets of Ties. RGBS and Audio are shown as separate lines.



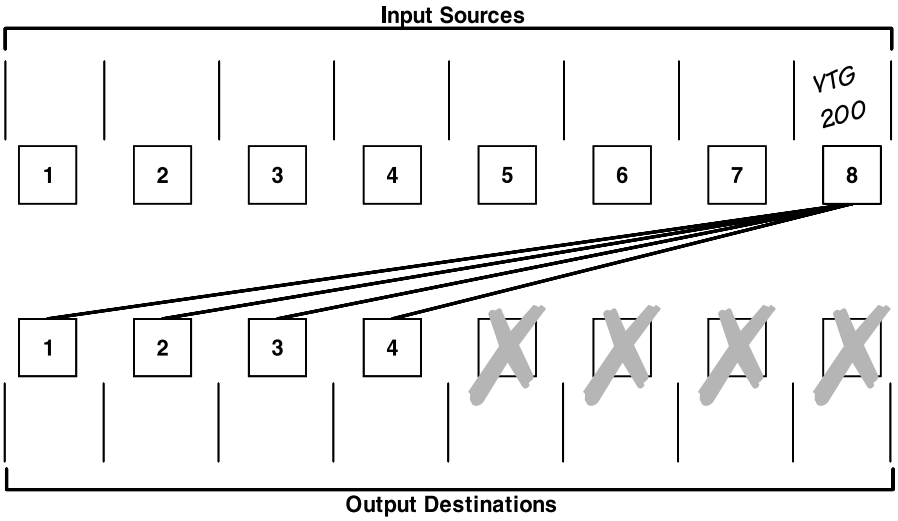
Rather than try to remember the configuration for each preset, worksheets may be used to record this information. Make copies of the worksheets provided on the next page and use one for each Preset configuration.

Example #5
This configuration was stored as Preset 7. It has one set of Ties for Input 8. Because it was stored to do test patterns, only RGBS is tied to the Video Test Generator source.

When diagramming for more than one I/O module, use different colors for each I/O module.

For our own records, we chose the title “Test Patterns”.

Because the matrix is 8x4, outputs 5 - 8 have been crossed out in this example.

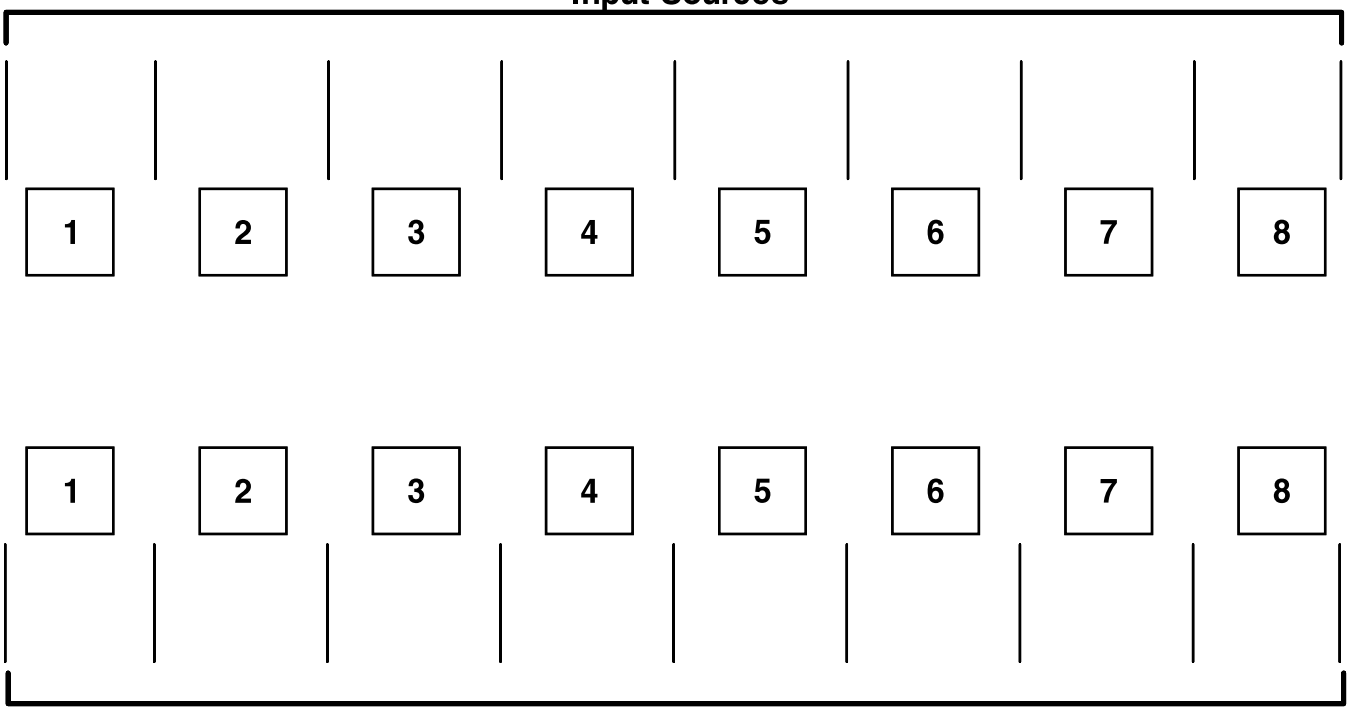


Matrix 200 Configuration Worksheet

Preset # 7 **Title** *Test Patterns* **RGBS** _____ **Audio** _____ **Video** _____

Fill in Preset number and colors (or codes) used to make connecting lines for each I/O module type.

Input Sources



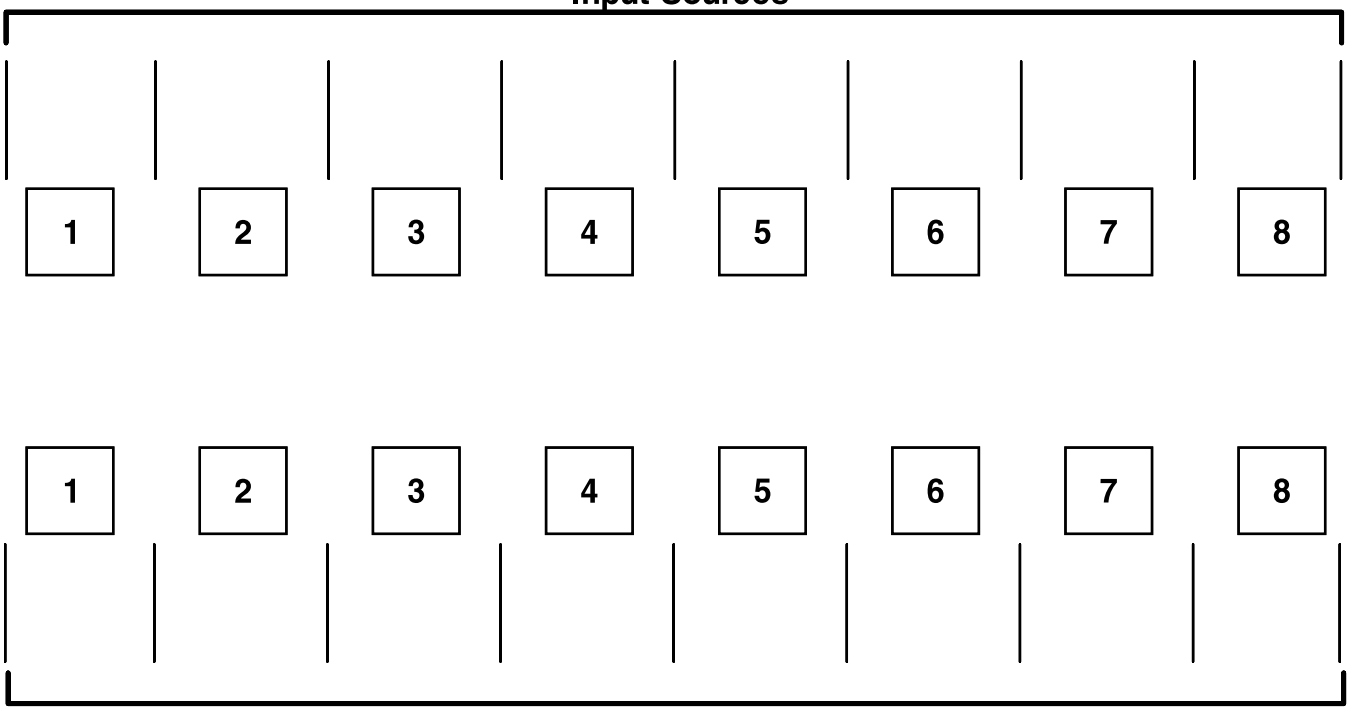
Output Destinations

Matrix 200 Configuration Worksheet

Preset # _____ **Title** _____ **RGBS** _____ **Audio** _____ **Video** _____

Fill in Preset number and colors (or codes) used to make connecting lines for each I/O module type.

Input Sources



Output Destinations

Matrix 200 Configuration Worksheet

Preset # _____ **Title** _____ **RGBS** _____ **Audio** _____ **Video** _____

Fill in Preset number and colors (or codes) used to make connecting lines for each I/O module type.

Matrix 200
User's Manual

5

Chapter Five

Windows® Software Control

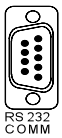
Installing the Software

Operating Examples

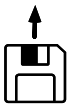
Using Help

Extron Matrix Control Software

Extron supplies controller software that runs in the Windows® operating system, version 3.1 or later. Install the software from the 3.5" floppy disk, just like any other Windows application. (Run Setup.exe from the floppy disk.) This software, called "Matrix 100/200 Control Program", works with both the Matrix 100 and Matrix 200 switchers. Its operation will be restricted to the features and configuration of your Matrix.



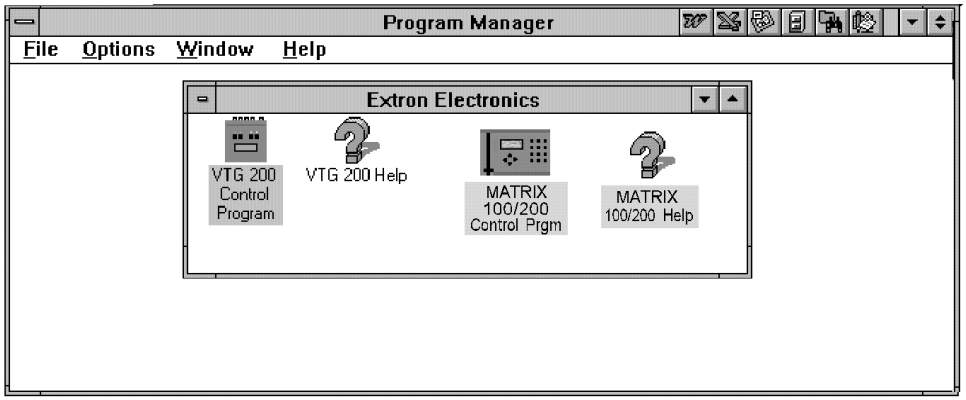
Communication between the computer software and the Matrix is established after connecting the computer to the RS-232 Comm Port on the rear panel of the Matrix 200. See Page B-1 for more information on this port.



Installation of the software creates a Program Group (Windows 3.1) or a Folder (Windows 95®) called "Extron Electronics". Icons for the Control Program and the Help Program are installed in that group or folder. Examples follow.

The Window below shows an Extron Program Group. This example is from Windows 3.1, and it includes Extron's installed VTG 200 Control Program; your system may not have the VTG 200 Software. (VTG = Video Test Generator)

Extron Group Example



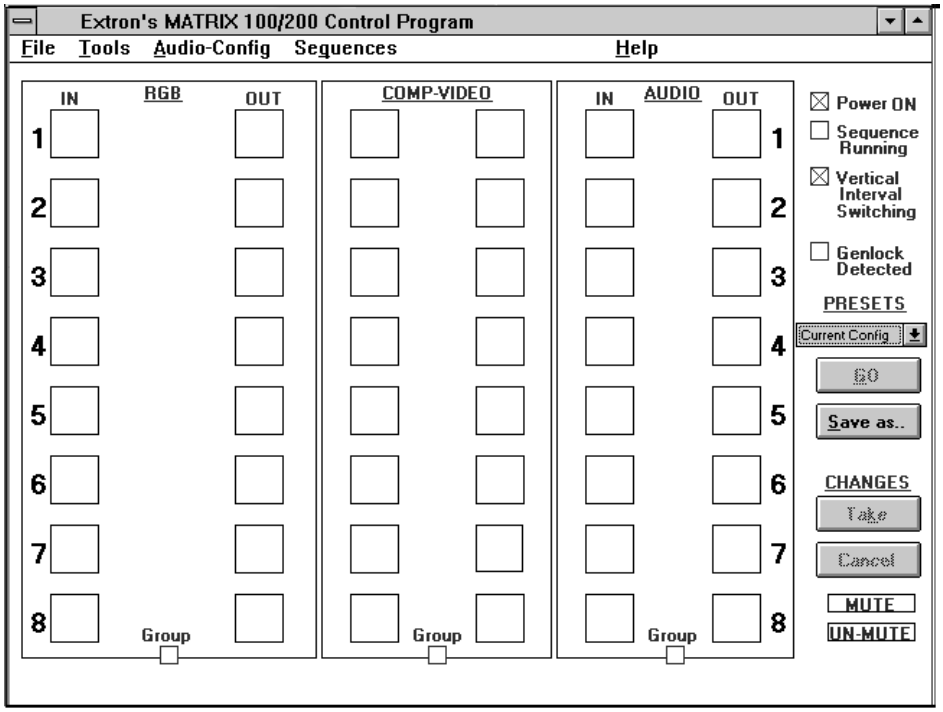
Windows Example

With the Matrix 100/200 Control software installed, double-click on the icon. You will be asked to select the PC's Comm Port. When communications has been established, the Matrix Control Software will "read" your Matrix.

Although detailed Help is provided in the software, this section of the manual is to inform the user as to what is available. Remember that this software is for more than one model of Matrix. Your version may not look exactly like these examples.

This will open a Control Program Window. (The following example is blank.)

Control Program Example

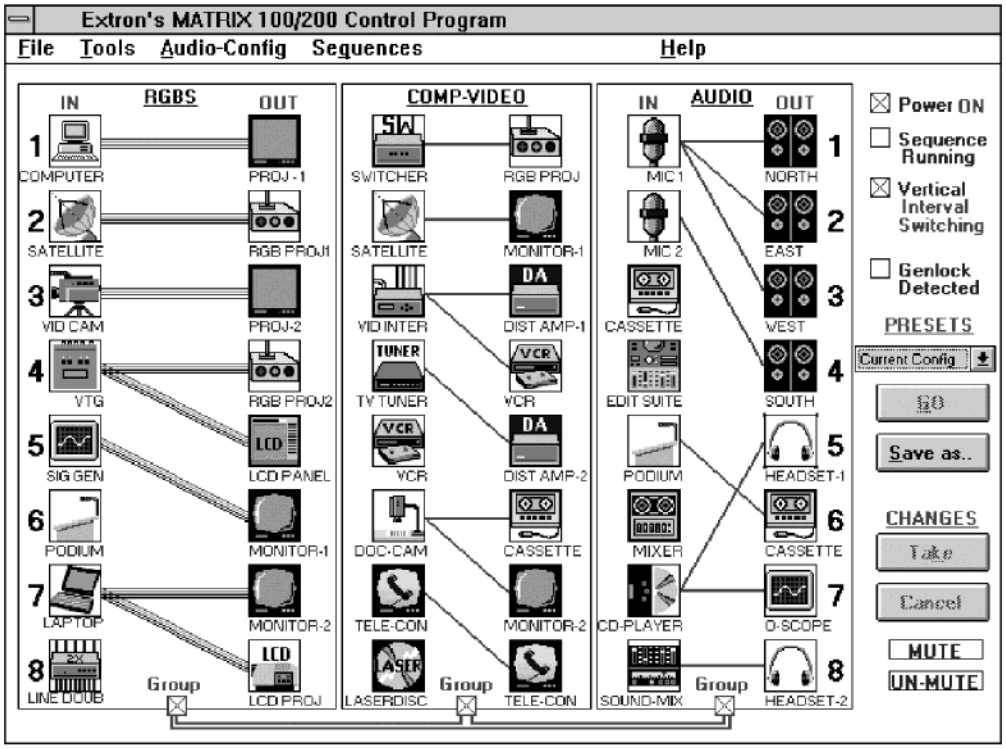


Drag an Input box to an Output box to make a “Tie” or connection.

Clicking on an Input or an Output box will open an appropriate dialog box with a choice of icons for either Input Devices or Output Devices. Click on the desired icon to assign it to the selected Input or Output. A Text Box at the bottom, marked “Caption”, allows the user to type in a name for that device. Click “Ok” to close the dialog box.

Below is an example of a Matrix Control Program Window complete with assigned Icons, Captions and Ties (connections).

Configured Matrix Example



Matrix 100/200 Help

Double-click on the Help Icon (or press F1 at any time) to open the Help Window. Below is an example of what this might look like.

As with all Windows® Help files, clicking on the underlined words will provide more detailed help.

Extron's Matrix 100/200 Help Contents

To learn how to use Help, press F1 or choose Using Help from the Help menu.

The Matrix Control program communicates with the Extron Matrix 100 and 200 Switchers through the unit's RS-232/422 port (defaults to 9600 baud, 8 bit, 1 stop, no parity). It presents the same functions found on the Front-Panel controller, but in an interactive graphical interface. Because settings to the Matrix (Ties, Presets, Sequences, Audio config) are stored in the unit's memory, several modes of 'programming' are possible. It provides 4 major methods:

- Remote control and programming of the unit in real time through the RS-232 port.
- Saving unit's settings for later restoration to the same unit (backup) or copying to (programming) another unit. Multiple configurations (programs) can be saved to disk and any one quickly reloaded later, providing an unlimited number of possible setups.
- Creating Program byte-strings for application to the Matrix through a third-party control system.
- Emulation (off-line) programming of the unit's settings for copying to a unit at a later time or another place. Emulation mode also allows creation of programs for any possible Matrix hardware configuration without being connected to such a unit.

To load a demonstration set of Ties, Presets and Sequences to your Matrix (or Emulate one) Restore from the DEMO.INI file which was installed with the Control Program. Use NEW.INI to clear all settings in a unit.

For Help on specific screens and buttons, click the appropriate item below:

Buttons & Controls of the Matrix Main Screen (graphically)
Buttons & Controls of the All other Screens

Note that pressing F1 from within the program will provide context-sensitive Help.

Appendix A

Part Numbers, Glossary and Troubleshooting

Related Part Numbers

Switcher Module Part Numbers

Extron Part	Part #
Blank Front Panel	60-147-01
Front Panel Controller (FPC)	60-146-01
QuickSwitch Front Panel Controller	60-188-01
Audio Connectors (Phoenix)	10-163-01
SVHS-to-BNC Adapter	26-353-01
GLI 350 - (Ground Loop Isolator, 250 MHz RGBHV)	60-223-02
PA 250 - (Peaking Amplifier, 200 MHz RGBS)	60-179-01
Matrix 200 User's Manual	68-126-01 - (this manual)
SC 110 Sync Combiner (115v)	60-153-01 (230v = 60-153-02)
SC 210 Sync Processor (115v)	60-154-01 (230v = 60-154-02)

Option Kit Part Numbers

Kits can be ordered from Extron for adding modules to an existing Matrix 200. The following list gives part numbers for available kits.

Matrix 200 Option Kit	Part #
Redundant Power Supply	70-020-01
8 x 8 Stereo Audio Module	70-022-01
4 x 4 HRAM (for RGB)	70-023-01
8 x 4 HRAM (for RGB)	70-023-02
8 x 8 HRAM (for RGB)	70-023-03
4 x 4 Sync Module	70-058-01
8 x 4 Sync Module	70-058-02
8 x 8 Sync Module	70-058-03
4 x 4 Composite Video	70-025-01
8 x 4 Composite Video	70-025-02
8 x 8 Composite Video	70-025-03

These kits include all the necessary parts, as well as instructions for a qualified person to add options to a Matrix 200. Chapter 2 of this manual includes some procedures for adding options.

When ordering an upgrade kit, it is necessary to know the revision level of the Matrix being modified.

- *The Main Controller has two labels on the bottom of the cabinet. One is the serial number and the other is the "ER" number. To be ready for audio, for example, the number must be ER7670 or greater.*
- *If the serial number has an "A" after it, that also means the unit can accept Audio.*
- *If the Matrix has a Front Panel Controller (FPC), its firmware must be version 1.3 or greater. (There is no connection between the FPC version number and the one for the Main Controller board.)*

If your Matrix 200 is not at the required level, the appropriate upgrade kit(s) will be shipped with the option kit.

BNC-4 HR Cables (Mini High Resolution BNC Cables)

Extron BNC-4 HR cables are mini high resolution (HR) BNC cables, color coded with solid colors and wrapped in a single jacket. The total cable diameter is 0.327". Extron recommends that when using signals with a scanning frequency of 15-125 kHz and running distances of 100 feet or more, high resolution BNC cables should be used to achieve maximum performance. The following cables are stock lengths:

Cable - Length	Part #
BNC-4-3' HR	26-210-01
BNC-4-6' HR	26-210-02
BNC-4-12' HR	26-210-03
BNC-4-25' HR	26-210-04
BNC-4-50' HR	26-210-05
BNC-4-75' HR	26-210-06
BNC-4-100' HR	26-210-07
BNC-4-150' HR	26-210-08
BNC-4-200' HR	26-210-09
BNC-4-300' HR	26-210-53
BNC-4-500' HR	22-032-02 (Bulk Length)
BNC-4-1000' HR	22-032-03 (Bulk Length)

BNC Mini High Res Cable Specifications

Impedance	75 Ohm
Resistance	41 Ohm/1000 ft.
Capacitance	17 pF/ft.
Time Delay	1.2 ns/ft.
Insulation	Foam Polypropylene
Propagation	1.15 ns/ft.
Outer Dimension	0.327 ± 0.010" (BNC-4), 0.361 ± 0.010" (BNC-5)
Ratings	NEC CL-2 (E63912-C)
	NEC CL-2P (Plenum-Rated Cable)
	UL-AWM 2990 VW-1
Bulk Lengths	500 and 1000 ft. spools

BNC-5 HR Cables

High resolution 5 conductor BNC cables include cables for Red, Green, Blue, Horizontal and Vertical Sync. These cables are required when using the Matrix 200 with separate horizontal and vertical sync inputs and outputs. The specifications are the same for the BNC-5 HR and BNC-4 HR cables. The total cable diameter is 0.361".

Cable - Length	Part #
BNC-5-3' HR	26-260-15
BNC-5-6' HR	26-260-01
BNC-5-12' HR	26-260-02
BNC-5-25' HR	26-260-03
BNC-5-50' HR	26-260-04
BNC-5-75' HR	26-260-16
BNC-5-100' HR	26-260-05
BNC-5-150' HR	26-260-12
BNC-5-200' HR	26-260-06
BNC-5-300' HR	26-260-14
BNC-5-500' HR	22-020-02 (Bulk Length)
BNC-5-1000' HR	22-020-03 (Bulk Length)

Matrix 200 Part Numbering System

Because the Matrix 200 can be factory-configured with many combinations of switcher modules, the diagram below illustrates how the part numbers are derived.

All Matrix 200 part numbers begin with 60-138, the remaining digits are determined by other options. Use this diagram when ordering a new Matrix 200.

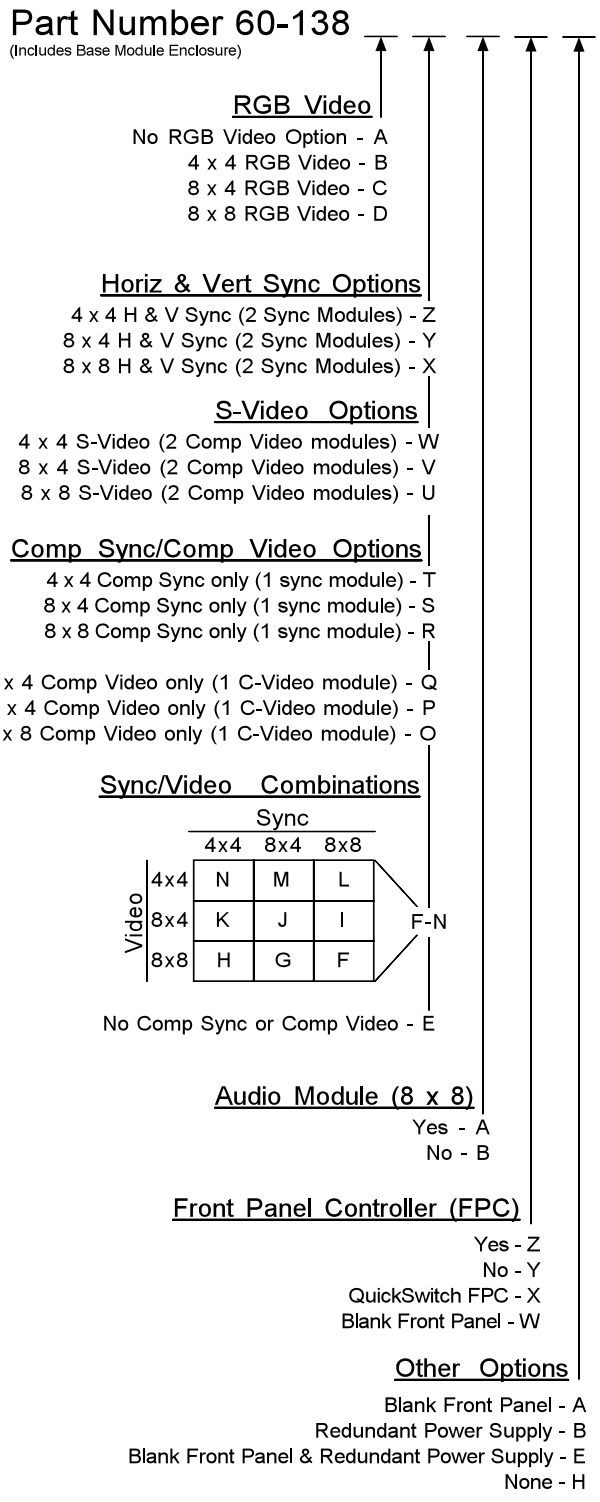
1. S-Video uses two Composite Video modules that are tied together. The hardware is the same, the difference is how they are used.
2. If a Matrix has S-Video, it cannot have a sync module.

Example 1:
A Matrix 200 with
8 x 8 RGB,
8 x 8 Hor. & Vert. sync,
Stereo Audio,
FPC and a
Redundant Power Supply
will have the part number:
60-138DXAZB

Example 2:
A Matrix 200 with
8 x 4 RGsB,
8 x 4 S-Video,
Stereo Audio,
and an FPC
will have the part number:
60-138CVAZH

Example 3:
A Matrix 200 with
4 x 4 RGBS,
8 x 4 Composite Video,
and a Blank Front Panel
will have the part number:
60-138BKBYA

This number will be on a label on the shipping box.



Glossary of terms

AC – Alternating Current –
Flow of electrons that changes direction alternately.

ADA – Analog Distribution Amplifier – A device that takes in one signal and distributes it to several outputs without "tying" those outputs together (buffered).

Adapter – A linking device which allows two dissimilar devices to connect physically, and/or communicate electronically.

AMPS – (Amperes) A unit of measurement for current.

Analog (Analogue) – A continuous action, or movement that takes time to change from one position to another. Standard audio and video signals are analog. An analog signal has an infinite number of levels between its highest and lowest value. (Not like digital, where changes are by steps.)

ANSI – American National Standards Institute

ASCII – American Standard Code for Information Interchange. The standard code consisting of 7-bit coded characters (8 bits including parity check), utilized to exchange information between data processing systems, data communication systems, and associated equipment. The ASCII set contains control characters and graphic characters.

Aspect Ratio – The relationship of the horizontal dimension to the vertical dimension of a rectangle. In viewing screens, standard TV is 4:3, or 1.33:1; HDTV is 16:9, or 1.78:1. Sometimes the ":1" is implicit, making TV = 1.33 and HDTV = 1.78.

Attenuation – The decrease in magnitude (of a signal).

Audio Follow – A term used when audio is tied to other signals, such as video, and they are switched together. (The opposite of Breakaway)

Balanced Audio – A method that uses three conductors for one audio signal. They are plus (+), minus (-) and ground. The ground conductor is strictly for shielding, and does not carry any signal. Also called Differential Audio.

Bandwidth – A frequency range, or "band" of frequencies, within which a device operates. In audio and video, it is the band of frequencies that can pass through a device without significant loss or distortion. The higher the bandwidth, the sharper the picture; low bandwidth can cause a "fuzzy" picture.

Black Level – More commonly referred to as "brightness", the Black Level is the level of light produced on a video screen.

Blanking – The turning off of the electron beam that scans the image onto the screen. When the beam completes a scan line it must return (retrace) back to the left. During this time, the beam must be turned off (horizontal blanking). Similarly, when the last line has been scanned at the bottom of the screen, the beam must return to the upper left. This requires vertical blanking.

Blooming – Most noticeable at the edges of images on a CRT, "blooming" is when the light hitting the screen phosphors is so intense that it overdrives them. The edges of an image seem to exceed its boundaries. Thin lines and sharp edges may look thick and fuzzy. This may be caused by the brightness being set too high, or by a high voltage problem.

BNC – It is a cylindrical Bayonet Connector which operates with a twist-locking motion. Two curved grooves in the collar of the male connector are aligned with two projections on the outside of the female collar. This allows the connector to be locked in place without the need of tools.

Breakaway – The ability to separate audio and video signals for the purpose of switching them independently. For example: an audio and video signal from the same source may be “broken away” and switched to different destinations. This is the opposite of the term “audio follow”.

Brightness – Usually refers to the amount, or intensity of video light produced on a screen. Sometimes called “black level”.

Buffer – Generally referred to as a unity gain amplifier used to isolate the signal source from the load. This is for both digital and analog signals.

C – In S-Video, “C” is an abbreviation for Chrominance, or the color information. (“Y” is for Luminance, or the brightness.)

Cable Equalization – The method of altering the frequency response of a video amplifier to compensate for high frequency losses in cables that it feeds. (See Peaking.)

Capacitance – The storing of an electrical charge. At high frequencies, capacitance that exists in cables also represents a form of impedance.

Chroma – The characteristics of color information, independent of luminance intensity. Hue and saturation are qualities of chroma. Black, gray, and white objects do not have chroma characteristics.

Chrominance Signal – Part of a television signal containing the color information. Abbreviated by “C”.

Coaxial Cable – A two-conductor wire in which one conductor completely wraps the other with the two separated by insulation. Constant impedance transmission cable.

Color – An Extron adjustment that is used to control color intensity.

Component Video – Our color television system starts with three channels of information; Red, Green, & Blue (RGB). In the process of translating these channels to a single composite video signal they are often first converted to Y, R-Y, and B-Y. Both 3-channel systems, RGB and Y, R -Y, B -Y are component video signals. They are the components that eventually make up the composite video signal. Much higher program production quality is possible if the elements are assembled in the component domain.

Composite Sync – A signal combining horizontal and vertical sync pulses, and equalizing pulses, with no picture information. Sometimes called ”C”, “S” (as in RGBS) or “HV”.

Composite Video – An all-in-one video signal comprised of the luminance (black and white), chrominance (color), blanking pulses, sync pulses and color burst.

Contrast – The range of light and dark values in a picture, or the ratio between the maximum and the minimum brightness values. Low contrast is shown mainly as shades of gray, while high contrast is shown as blacks and whites with very little gray. It is also a TV monitor adjustment which increases or decreases the level of contrast of a displayed picture. Also called “white level”.

Crosstalk – Interference, usually from an adjacent channel, which adds an undesirable signal to the desired signal.

Crosstalk Isolation – Attenuation of an undesired signal introduced by crosstalk.

CRT (Cathode Ray Tube) – A vacuum tube that produces light on a screen when energized by the electron beam from inside the tube. A CRT has a heater element, cathode, and grids in the neck of the tube, making up the “gun”. An electron beam is produced by the gun and is accelerated toward the screen surface of the tube. The screen’s inside surface is coated with phosphors that light up when hit by the electron beam. The CRT is more commonly known as the picture tube. Some color CRTs have three guns – for red, green and blue colors.

DAT (Digital Audio Tape) – A method developed by Sony and Hewlett-Packard for recording large amounts of information in digital form on a small cassette tape. It uses a rotating helical read/write head, similar to the technique used on a VCR.

dB (Decibel) – The standard unit used to express gain or loss of power. It indicates the logarithmic ratio of output power divided by input power. A power loss of 3 dB is an attenuation of half of the original value. The term “3dB down” is used to describe the “half power point”.

DC – Direct Current – The flow of electrons in one direction.

D Connector – A connector with rounded corners and angled ends, taking on the shape of the letter “D”. Commonly used in computers and video.

Decibel – See dB.

Decoder – A device used to separate the RGBS (Red, Green, Blue and Sync) signals from a composite video signal. Also called NTSC Decoder.

Detail – An Extron Technologies adjustment that enhances/improves image sharpness.

Differential Audio – See Balanced Audio.

Digital Audio Tape – See DAT.

DIN Connector – An acronym for Deutsche Industrie Norm - a round connector with notches, or keyed that can be in several sizes: 4-pins, 5-pins, 8-pins, etc. A convenient way of combining all the signal lines in one connector, 4-pin DIN connectors are often used for S-Video.

Display Device – A projector or monitor.

Distribution Amplifier (DA) – A device that allows connection of one input source to multiple output sources such as monitors or projectors.

DVD – (Digital Versatile Disc or Digital Video Disc) An optical disc system about the size of a CD ROM, but capable of storing an entire movie. The technology uses MPEG-2 compression. Typical capacity for these discs is 4.5 GB, or about 133 minutes of digital video.

FCC – Federal Communications Commission –
A unit of the U.S. Government that monitors and regulates communications.

Field – In interlaced video, it takes two scans on a screen to make a complete picture, or a “Frame”. Each scan is called a “Field”. Sometimes these are referred to as “field 1 and field 2”.

Flicker – Flicker occurs when the electron gun paints the screen too slowly, giving the phosphors on the screen time to fade.

Frame – In interlaced video, a Frame is one complete picture. A Frame is made up of two fields, or two sets of interlaced lines.

Frequency Range – Refers to the low-to-high limits of a device, such as a computer, projector or monitor. Also “bandwidth”.

Gain – A general term used to denote an increase in signal power or voltage produced by an amplifier in transmitting a signal from one point to another. Gain is usually expressed in decibels above a reference level. Opposite of Attenuation.

Genlock – A method of synchronizing video equipment by using a common, external sync, or “Genlock” signal.

H or H/V – Horizontal (H) sync, or Horizontal and Vertical sync combined (H/V). On connector panels, H identifies the connector for Horizontal Sync and H/V means it is also used for combined, or "composite" Horizontal and Vertical Sync.

Hertz (Hz) – A measure of frequency in cycles per second.

High Impedance – (Hi Z or High Z) – In video, when the signal is not terminated locally and is going to another destination where it will be terminated. In video, Hi Z is typically 10k ohms or greater.

Horizontal Rate – (Horizontal Frequency) The number of complete horizontal lines, including trace and retrace, scanned per second. Typically shown as a measure of kHz.

Horizontal Resolution – Smallest increment of a video picture in the horizontal plane is a scan line. The number of scan lines is dependent upon the video bandwidth and is measured in frequency. The number of lines it takes to scan an image onto the screen.

HSB – In color graphics, Hue-Saturation-Brightness. (Hue = the color, Saturation = the amount of color, and Brightness = the amount of white).

Hue (Tint Control) – Red, yellow, blue, etc. are hues of color or types of color. Hue is the parameter of color that allows us to distinguish between colors. The Hue, or Tint control adjusts the amount of color displayed. Also see HSB.

Hz (Hertz) – Frequency in cycles per second.

Impedance (Z) – The opposition to (or load on) a signal. Circuits that generate audio or video signals, are designed to work with a certain "load", or impedance. Typical video impedances: 75 ohm or High Z. Also see High Impedance and Low Impedance.

Interlaced – A picture is made up of two fields. Interlacing is the process whereby the lines of one scanned field fall evenly between the lines of the preceding field.

K – An abbreviation for 1,000. A kilobyte is 1,000 bytes. In computer memory sizes, the numbers are rounded down. e.g. 1k byte = 1024 bytes.

Kilohertz (kHz) – Thousands of Hertz, or a thousand cycles per second. For example, CGA's horizontal scan rate is 15.75 kHz or 15,750 hertz (Hz).

LCD – Liquid Crystal Display – A panel that utilizes two transparent sheets of polarizing material with a liquid containing rod-shaped crystals between. When a current is applied to specific pixel-like areas, those crystals align to create dark images. LCD panels do not emit light but are often backlit or side-lit for better viewing.

LCD Projector – Utilizing the LCD technique, these projectors separate the red, green and blue information to three different LCD panels. Since LCD panels do not produce color, the appropriate colored light is then passed through each panel and combined to exit through the projector lens and onto a viewing screen.

LED – Light-Emitting Diode – A low-power, long life, light source, usually red, green or yellow in color. Some LEDs can produce two different colors.

Level Control – The Level Control on some interface products is similar to the Contrast Control on a data monitor. It can increase or decrease the signal level, resulting in greater or less contrast in the picture.

Low Impedance – The condition where the load has a less opposition to a signal. Low load impedances can drag the signal down and may cause a fault condition.

Luminance – This is the signal that represents brightness in a video picture. Luminance is any value between black and white. In mathematical equations, luminance is abbreviated as "Y". (See Chrominance.)

Matrix Switcher – In audio/video, a means of selecting an input source and connecting it to one or more outputs. Like a Switcher, but with multiple inputs and multiple outputs.

M (Mega) – An abbreviation for one million. A megabyte is actually 1024K, or roughly a million bytes (1,048,076 to be exact [1024 x 1024]).

MHz (as in 8 MHz) – An abbreviation for megahertz. This is a unit of measurement and refers to a million cycles per second. Video bandwidth is measured in megahertz.

Milli (m) – Abbreviation for one thousandths. Example: 1 ms = 1/1000 second.

Monitor – A) A TV that receives a video signal directly from a VCR, camera or separate TV tuner for high quality picture reproduction. It does not include a tuner.
B) A video display designed for use with closed circuit TV equipment.
C) Device used to display computer text and graphics.

Monochrome Signal – A "single color" video signal— usually a black and white signal, or sometimes the luminance portion of a composite or component color signal.

Motion – In video, the term "motion" is used as opposed to "still" because there can be a difference in the way these two types of video are processed for the best viewing results, especially when the video is line-doubled or line-quadrupled. Motion video includes movies and TV programs, while still would include text and slide presentations. See Still.

Non-Interlaced – Also called progressive scan – a method by which all the video scan lines are presented on the screen in one sweep instead of two (also see Interlaced).

NTSC – National Television Standards Committee. Television standard for North America and parts of South America. 525 lines/60 Hz (60 Hz Refresh).

NTSC Decoder – See Decoder.

Output – The product of an operation by a device going to some external destination, such as another device, a video screen, image or hard copy.

PAL (Phase Alternate Line) – The phase of the color carrier is alternated from line to line. It takes four full pictures for the color to horizontal phase relationship to return to the reference point. This alternation helps cancel out phase errors, the reason the hue control is not needed on PAL TV sets. PAL, in its many forms is used extensively in Western Europe.

Peak-to-Peak – (abbreviated p-p) The amplitude (voltage, for example) difference between the most positive and the most negative excursions (peaks) of a signal.

Peaking – A means of compensating for mid and high frequency RGB Video Bandwidth response in data monitors and projectors and for signal losses due to cable capacitance. When using the Peak enhancements, use the following guidelines for proper output settings: Use 50% with all computer frequencies between 15-125 kHz at any cable length. Use 100% with high frequency computers of 36 kHz or higher with cable lengths 75 feet or greater.

Pinout – An illustration or table that names signals, voltages, etc. that are on each pin of a connector or cable.

Plenum Cable – Cable having a covering that meets the UL specifications for resistance to fire.

PLUGE – (Picture Line Up Generation Equipment) –
This is the name of a test pattern that assists in properly setting picture black level. PLUGE can be part of many test patterns. The phrase and origination of the test signal are both credited to the BBC.

Power (Electrical) – The dissipation of heat by passing a current through a resistance. Measured in Watts (W), it is expressed by Ohm's law from the two variables: Voltage (E) and Current (I). i.e. $P = I^2xR$, or, $P = E^2/R$ or $P = ExI$

Progressive Scan – See non-interlaced.

Resolution – The density of lines or dots that make up an image. Resolution determines the detail and quality in the image. (units per distance or units per area)
A) A measure of the ability of a camera or video system to reproduce detail.
B) In video, generally called horizontal resolution. It can be evaluated by establishing the limit to which lines can be distinguished on a test pattern. A higher resolution value means a broader frequency band of the video signal.
C) A measure of the amount of detail that can be seen in an image. Often incorrectly expressed as a number of pixels; more correctly it is the bandwidth.

RGB (Red, Green, Blue) – The basic components of the color television system. They are also the primary colors of light, not to be confused with Cyan, Magenta, and Yellow, the primary pigments. Also called the "Additive Color Process".

RGB Video – A form of color video signal (red, green, blue) distinctly different from the composite color video used in standard television sets. RGB can be displayed only on a color monitor that has a separate electron gun for each of these primary colors. Some color television sets use only one gun. RGB monitors are noted for their crisp, bright colors and high resolution. RGB Video can be threedifferent ways: RGsB (sync is on the green signal), RGBS (sync is separate from the colors) and RGBHV (sync is separate from the colors and the horizontal and vertical are separate signals).

RS-232 – An Electronic Industries Association (EIA) serial digital interface standard specifying the characteristics of the communication path between two devices using D-type connectors. This standard is used for relatively short range communications and does not specify balanced control lines.

RS-422 – An EIA serial digital interface standard which specifies the electrical characteristics of balanced voltage digital interface circuits. This standard is usable over longer distances than RS-232. It is also used as the serial port standard for Macintosh computers. This signal governs the asynchronous transmission of computer data at speeds of up to 920,000 bits per second.

Scan Converter – Also called "video converter" or "TV converter", a scan converter is a device that changes the scan rate of a source video signal to fit the needs of a display device. Examples: computer-video to NTSC (TV), or NTSC to computer-video.

SECAM – (Sequential Couleur Avec Memoiré) – Translated as "Sequential Color with Memory". A composite color transmission system that potentially eliminates a need for both a color and hue control on the monitor. One of the color difference signals is transmitted on one line and the second is transmitted on the second line. Memory is required to obtain both color difference signals for color decoding. This system is used in France, Africa, Asia and many Eastern European countries.

Serial Port – An input/ouput connection on the computer that allows it to communicate with other devices in a serial fashion – data bits flowing on a single pair of wires. The serial port is most often used with RS-232 protocol.

SMPTE – (Society of Motion Picture and Television Engineers) – A global organization, based in the United States, that sets standards for baseband visual communications. This includes film as well as video standards.

SMPTE Pattern – The video test pattern made up of color, black and white bands.

Still – In video, the term “still” is used as opposed to “motion” because there can be a difference in the way these two types of video are processed for the best viewing results, especially when the video is line-doubled or line-quadrupled. Still video includes text and slide presentations, while motion would include movies and TV programs. See Motion.

Strike – In the Audio/Video business, this is the tearing down of an installation or show.

Switcher – A device which allows the selection between more than one signal (for example: video cameras, VCRs, etc.).

Sync – In video, a means of synchronizing signals with timing pulses to insure that each step in a process occurs at exactly the right time. For example: Horizontal Sync determines exactly when to begin each horizontal line (sweep) of the electron beam. Vertical Sync determines when to bring the electron beam to the top-left of the screen to start a new field. There are many other types of sync in a video system. (Also called Sync Signal or Sync Pulse.)

S-VHS – (Super-Video Home System) A high band video recording process for VHS that increases the picture quality and resolution capability. See S-Video.

S-Video – The video signal is separated into the Luminance (Y, black and white information) and the Chrominance (C, color information).

Switcher – In audio/video, a means of selecting an input source and connecting it to an output device or a system. Also see Matrix Switcher.

System Switcher – A switching device that communicates with other components in a system. For example, with communications between a switcher and a projector, the projector’s remote control can command the switcher to change inputs. Also, the projector can be turned on/off by a command from the switcher.

Terminal – A device typically having a keyboard and display that is capable of sending text to and receiving text from another device, a network, etc.

Termination – A load, or impedance at the end of a cable or signal line used to match the impedance of the equipment that generated the signal. The impedance absorbs signal energy to prevent signal reflections from going back toward the source. In the video industry, termination impedance is typically 75 ohms.

Tint – See Hue.

Touch Panel – A control panel with a flat surface with areas (usually marked off) that act as switches, or controls. May also be called “Touch Screen”.

V– Vertical (as in RGBHV), or the Vertical Sync connector on a panel. This is used when the sync is separated into Horizontal and Vertical components.

Video Converter – See Scan Converter.

Vertical Interval – The synchronizing information which is presented between fields, and then signals the picture monitor to return to the top of the screen to start another vertical scan.

Y – In S-Video, “Y” is an abbreviation for Luminance. (“C” is for chrominance.)

Z – A symbol for impedance.

Troubleshooting

The following Q & A section, "Frequently Asked Questions", is composed of questions and answers to typical problems and situations encountered by users of the Matrix 200. We hope that the information will be both helpful and informative during your implementation of the Matrix 200.

Frequently Asked Questions

Q: I have connected up the Matrix 200 and programmed it, but it is not passing all the signals. What should I do?

A: Confirm that all the Matrix 200 input and output cable connections have been properly made. When dealing with multiple inputs and outputs with several cables per input/output, it is very easy to incorrectly route the wiring — yet, this is often the last item checked when troubleshooting. Possible wiring errors include:

- Crisscrossing one wire of an input or output e.g., connecting the red wire of input number one to the red connector of input number two instead.
- Running five wires to an input, but running four wires at the corresponding output.
- Reversing the horizontal and vertical sync wires.

Once the wiring has been rechecked, verify that the Matrix has been programmed correctly. Review the programming instructions in the manual. In particular, double check that all input-output routing is correct. Likewise, verify that the individual RGB planes are not being broken away — be sure that the RGB and sync planes are switching together (if that is what is intended).

Keep in mind that the Extron supplied Windows based Matrix 200 control program can be used to verify Matrix 200 settings. **This is one of the best troubleshooting tools to use when working with the Matrix 200** (other Extron Matrix switchers have similar programs). This program will graphically show all current input-output ties along with the type of video signal (RGBHV, RGBS, Composite Video, etc.) being programmed. It simplifies verifying input-output ties, presets, and audio settings.

The Extron Matrix control program is also useful for checking a third party controller's programming code. With the Extron control program, a desired tie can be made and the ASCII code will be displayed. This information can then be used to verify that a third party controller has been programmed correctly.

Q: How can I control the Matrix 200?

A: The Matrix 200 can be controlled through the front panel, or through a third party controller via RS-232/422, or through the Extron supplied Windows control program. It can also be controlled with various terminal programs such as Windows Hyper Terminal.

The front panel will remain active if the unit is being controlled by RS-232/422 so the Matrix can take commands from both sources.

Q: My Matrix 200 seems to be taking too long to switch, why is this?

A: Check the RGB to sync delay feature. This is a built in delay function which allows the video time to sync up. It may be set too long, thus, causing the delay.

Q: Does the Matrix 200 provide genlock capability with RGB/video?

A: The Matrix 200 does provide genlock capability with video. This feature is not applicable to RGB video since genlock is a composite video characteristic.

Q: My Matrix 200 is not responding to RS-232 commands. What should I check?

A:
- Make sure you're allowing enough time between commands. The Matrix 200 issues a response code to every command it receives to inform the sender of the status of the last command, and new commands can not be accepted during this time. We suggest allowing 100 milliseconds between commands. (Less time can be allowed if the controller reads the response commands from the Matrix 200. It can be programmed to send a new command as soon as it receives the Matrix 200 response.)
- Double check your RS-232 connections. It is generally best to only use three pins (transmit, receive, and ground). We have found certain computers will not work well when all nine RS-232 wires are connected.
- When using the code from this manual, enter only the commands and not the commas used to separate the commands.
- Confirm that the baud rate of the Host is the same as that of the Matrix 200 (default = 9600 baud). The Host should be set to: Data = 8 bits, Stop bits = 1, Parity = none, Flow Control = Xon/Xoff.

Q: Can I run composite video or S-video through the Red, Green or Blue inputs?

A: Yes. In fact, because of the RGB plane breakaway capability, the Matrix 200 RGB planes can be used as three independent video switchers. A Matrix 200 with three 8 x 4 planes [Red, Green, and Blue planes] can be used as three independent 8 x 4 composite video switchers, or as one S-video switcher and one composite video switcher.

Q: Can I run composite video or S-video through the Matrix 200 sync inputs?

A: No. The sync channels are not made for video.

Q: Can I run five wire in and four wire out?

A: No. The Matrix 200 will not alter a video signal passing through it. There is no sync combining feature within the unit. We recommend the Extron SC 210 for this purpose.

Q: Can I use a second front panel?

A: Yes, the Matrix 200 will support up to two front panels. Even with two front panels the RS-232/422 control is still available.

Q: Can I use a remote front panel? And for what distance?

A: Yes. The Matrix 200 front panel can be used up to 150 feet away.

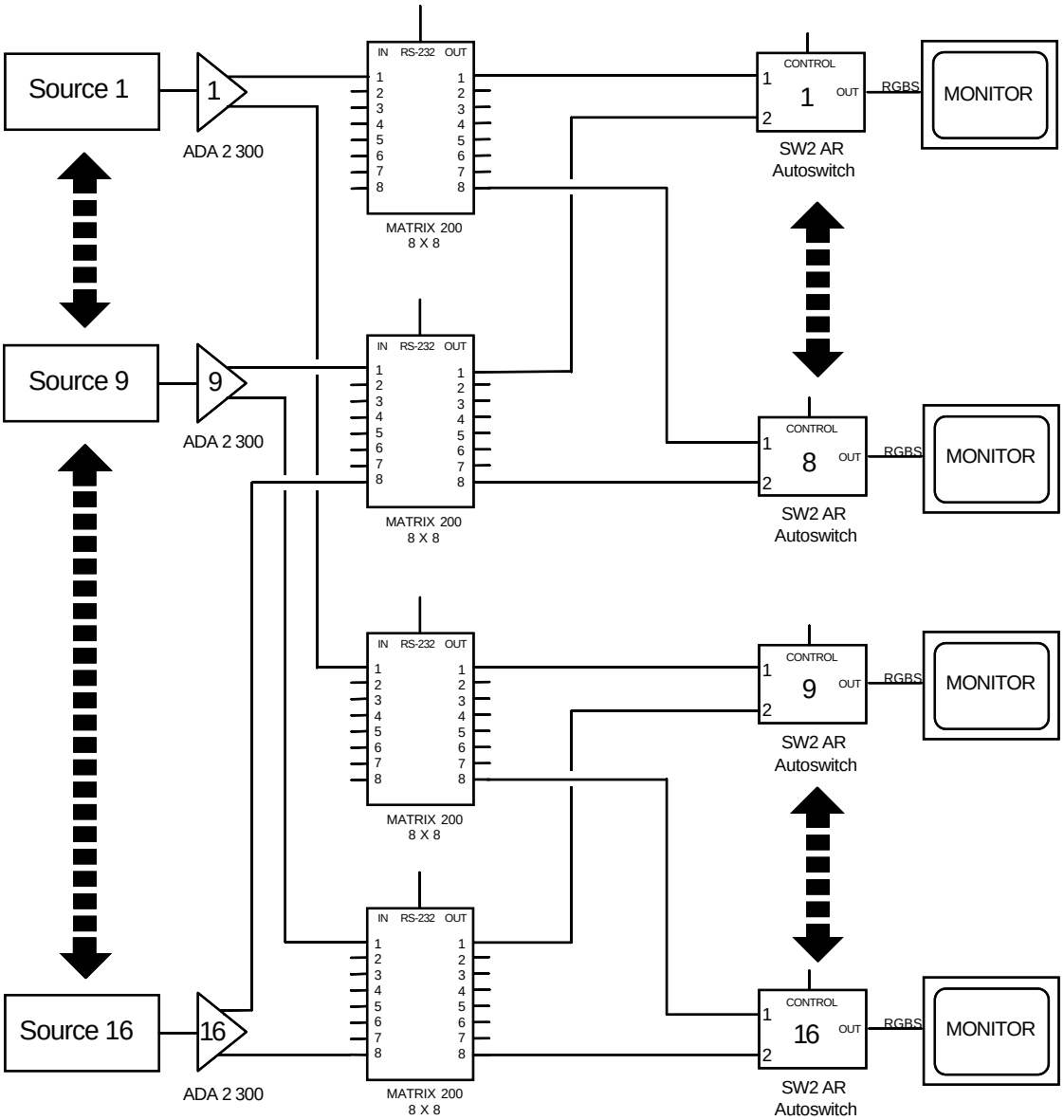
Q: Can I use the Matrix 100 front panel on the Matrix 200?

A: Yes, but you will lose control of certain functions, such as plane breakaway, with the Matrix 100 front panel (QuickSwitch). However, you can still do basic input to output ties.

When using a multiple matrix system, we recommend that a front panel be used with the Matrix 200. Should there be any problems, this will simplify the troubleshooting process considerably. A Matrix 100 front panel also works fine for this purpose.

Q: How can I expand the number of inputs and outputs of the Matrix 200 if the unit is fully loaded?

A: To expand the number of RGB inputs/outputs beyond an 8 x 8 configuration it is necessary to add additional Matrix switchers. DA's and/or switchers can be used to tie the Matrix switchers together. See the diagram below for an example of a 16 x 16 configuration. The use of DA's or switchers will vary depending on the particular configuration.



Matrix 200
User's Manual

B

Appendix B
Programming Guide

Control Ports

Host/Matrix Data Format

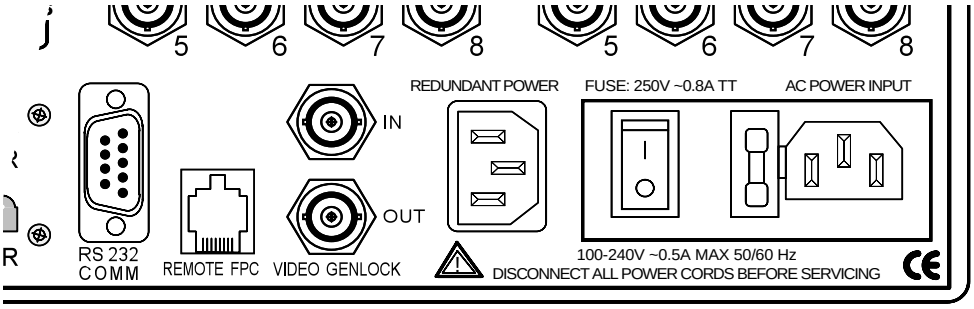
Command Structure

Communications Protocol

Using Commands

Control Ports

The picture below shows the connectors for two Control Ports: Remote FPC and RS 232 Comm.



FPC/QS-FPC Control Port

The Front Panel Controller (FPC) or QuickSwitch Front Panel Controller (QS-FPC) can be used two ways: It can be mounted directly to the Matrix 200, in which case it is connected to an RJ45 8-pin connector ("telephone cable") on the main controller board. The FPC/QS-FPC can also be dismounted from the front of the unit and used remotely at a distance of up to 100 feet. For remote operation, the FPC/QS-FPC is connected to the "Remote FPC" port located on the rear panel. The pin configuration for the Remote FPC port is shown below.

RJ45 8-pin Connections (Remote FPC)

Pin	Signal	Pin	Signal
1	Gnd	5	—
2	Gnd	6	Tx
3	Rec	7	+5
4	—	8	+5

RS-232/RS-422 Control Port

This is a 9-pin connector labeled "RS-232" located on the rear panel of the Matrix 200. Both simple and advanced instructions (see below) can be entered from a host device to the Matrix 200 through this port. Pin configuration for the RS-232/ RS-422 port is shown below.

RS-232/RS-422 Pin Connections

Pin	RS-232	Description	RS-422	Description
1	—	No Connection	TxD(-)	Transmit Data (-)
2	Tx	Transmit Data	TxD(+)	Transmit Data (+)
3	Rx	Receive Data	Rx(+)	Receive Data (+)
4	—	No Connection	Rx(-)	Receive Data (-)
5	Gnd	Signal Ground	Gnd	Ground
6	—	No Connection	—	No Connection
7	—	No Connection	—	No Connection
8	—	No Connection	—	No Connection
9	—	No Connection	—	No Connection

There is no Modem interface available on the Matrix 200.

The remaining sections of this appendix cover the details of programming the Matrix 200 from a Host system connected to the RS-232/RS-422 port. Before explaining the commands, the next few pages provide some preliminary information.

Program Instruction Levels: Simple and Advanced

The Matrix 200 recognizes any character that comes in on the RS-232/RS-422 port as a possible command. Commands can be from either of two groups or instruction sets. They are as follows:

1. ***The Simple Instruction Set*** *can be any ASCII character that is recognized by the Matrix 200 as a command. Simple commands could come from a terminal or any other controlling device. After the Matrix 200 receives the command, it will execute it and send an appropriate response to the controlling device.*
2. ***The Advanced Instruction Set*** *consists of more complex instruction strings. Advanced instructions are used when a complete command cannot be defined with one character. Each instruction string begins with a command and ends with an End Of Transmission code (EOT). Advanced commands could come from any controlling device capable of composing a command and sending it as a string. The Matrix 200 will execute any legal command string and send a response string back to the host.*

Because of this "open recognition", commands from the two instruction sets can be intermixed. Both instruction sets are listed and defined on pages that follow.

RS-232/RS-422 control can also be established from a computer using the Windows® operating system and Extron's software. This is covered separately in Chapter 5.

Host/Matrix Data Format

Data exchange between the Matrix 200 RS-232/RS-422 Controller and the external control host is based on a proprietary format and protocol. The communications is byte-oriented. All bytes fall into one of three categories:

Communication control	00 thru 1F hex
Matrix 200 command codes	20 thru 7F hex
Specific data	80 thru FF hex

Bits 0 thru 6 may be binary encoded, or they may represent numbers 00 thru 7F hex (decimal 0 thru 127).

Binary/hex/decimal Conversion Table

The table below shows how to convert data bytes from one numbering system to another. In Matrix 200 communications, all data bytes are identified by having bit 7 = 1, therefore it is not included in the computations.

Bit #s in byte:		7	6	5	4	3	2	1	0
Decimal value =		n/a	64	32	16	8	4	2	1
Dec.	Hex	Add the decimal values above for equivalents.							
0	80/00h	n/a	0	0	0	0	0	0	0
1	81/01h	n/a	0	0	0	0	0	0	1
2	82/02h	n/a	0	0	0	0	0	1	0
3	83/03h	n/a	0	0	0	0	0	1	1
4	84/04h	n/a	0	0	0	0	1	0	0
5	85/05h	n/a	0	0	0	0	1	0	1
6	86/06h	n/a	0	0	0	0	1	1	0
7	87/07h	n/a	0	0	0	0	1	1	1
8	88/08h	n/a	0	0	0	1	0	0	0
9	89/09h	n/a	0	0	0	1	0	0	1
10	8A/0Ah	n/a	0	0	0	1	0	1	0
11	8B/0Bh	n/a	0	0	0	1	0	1	1
12	8C/0Ch	n/a	0	0	0	1	1	0	0
13	8D/0Dh	n/a	0	0	0	1	1	0	1
14	8E/0Eh	n/a	0	0	0	1	1	1	0
15	8F/0Fh	n/a	0	0	0	1	1	1	1
16	90/10h	n/a	0	0	1	0	0	0	0
↕									
32	A0/20h	n/a	0	1	0	0	0	0	0
↕									
64	C0/40h	n/a	1	0	0	0	0	0	0
↕									
99	E3/63h	n/a	1	1	0	0	0	1	1
100	E4/64h	n/a	1	1	0	0	1	0	0
↕									
127	FF/7F	n/a	1	1	1	1	1	1	1

Simple Instruction Set

A simple command consists of a single character typed on a keyboard and preceded by ESC (1B hex). It is not necessary to press the “enter” key. A table of the simple commands is on the following page.

Related Terms

The following terms may be helpful in understanding information in the tables and examples that follow.

Line Feed/Carriage Return:

General – On most keyboards, pressing “enter” creates a line feed (lf) and a carriage return (cr). The screen cursor moves down one line (lf) and to the left margin (cr). This is done to prevent stringing unrelated information together. Because these are separate functions, the programmer may send them at any time and in either sequence (lf/cr or cr/lf). Also, some applications may issue these commands at the beginning of a sequence, at the end of a sequence, or both. Each response (as seen on a terminal display) will use it in one form or another.

Matrix 200 – The Matrix 200 uses lf/cr before and after each response (only in the Simple Instruction Set) and is symbolized as (↵) in examples that follow.

Display, or Display Device:

“Display” refers to the video output device (projector, monitor, etc.)

Host:

Any device capable of talking to the switcher through an RS-232/RS-422 port.

Switcher:

“Switcher” refers to the Matrix 200.

Terminal:

Any device that includes a keyboard and a display. This could be a “dumb” terminal, a “smart” terminal, a PC operating in “terminal” mode, etc.

Simple Instruction List

The following table shows the simple command set with responses for the Matrix 200. The Response column shows what will be seen on the host's screen. Appropriate response messages are also displayed on the Matrix 200's LCD screen. The Hex column gives hexadecimal equivalents for cases where the codes will be generated by another source.

All simple commands are preceded by ESC (1B hex). Version 1.8 of the Main Controller software supports the Simple Instruction Set.

Switcher Commands		ASCII	Hex	Matrix Response	Result Description
Switcher Power On	[ESC]	<	3C	↵SYS·1↵	Turn System Power On
Switcher Power Off	[ESC]	>	3E	↵SYS.0↵	Turn System Power Off
Executive Mode On	[ESC]	X	58	↵EXE·1↵	Turn Executive Mode On
Executive Mode Off	[ESC]	x	78	↵EXE·0↵	Turn Executive Mode Off
Display Part Number	[ESC]	N/n	4E/6E	↵N60-138-01↵	Return part number

Advanced Instruction Set Command Structure

All advanced commands follow the same pattern:

1. Command Specifier
2. Data (if any)
3. Checksum
4. End of Transmission Mark

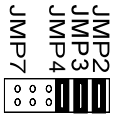
Command Specifier

The command specifier consists of one byte for short commands or two bytes for long commands. The first byte is the Command Code (CMD) in the range 20 hex thru 7F hex. The second byte of long commands is called the Subcommand (SCMD) and is treated as data (ranging from 80 hex to FF hex). A list of supported commands and detailed explanation are given later in this section.

Data

If present, data quantifies the commands. Their format is command-specific. Data is the useful part of the information exchange - i.e., the reason for sending and receiving commands. Data is in hexadecimal values, and bit 7 is always a "1", that is, the data bytes include 80h, plus 7 bits of information.

Checksum



The checksum (Cks) is a 2-byte field used to verify the integrity of the data that precedes it. The Matrix is shipped with jumper (JMP3) installed to disable the Checksum requirements. See page 2-7 to enable the Checksum feature.

When Checksum is disabled, the Cks1 and Cks2 bytes must still be included. They must each be data bytes (have a value between 80h and FFh).

Decimal calculation of Cks1 and Cks2:

1. Calculate the **Cks_remainder** of the (sum of transmitted bytes)/ 16,384**d**. As an example, where the sum of transmitted bytes is 41,665**d** (A2B7**h**), 41,655/16,384 = the quotient of 2 with the **Cks_remainder** of 8,887**d**.

2. Cks1 = the quotient of (**Cks_remainder**/128**d**) + 128**d.** In our example, Cks1 is (8,887/128) + 128 = the quotient of 69 + 128 = 197**d** (C5**h**).

3. Cks2 = the remainder of (**Cks_remainder**/128**d**) + 128**d.** In our example, Cks2 is (8,887/128) + 128 = the remainder of 55 + 128 = 183**d** (B7**h**).

The Checksum is built according to the following procedure:*

1. The binary sum (2-bytes wide) is calculated for all transmitted bytes starting with the command code and ending with the byte preceding the checksum. For example: The sum of transmitted bytes is A2B7**h** (41,655**d**), which translates to: `1010 0010 1011 0111`(binary)

2. Bits 15 and 14 (2 most significant bits) of the above sum are dropped.
   ~~10~~`10 0010 1011 0111` leaving `10 0010 1011 0111`

3. Remaining 14 bits are split into two 7-bit fields.
   Most significant remaining 7 bits = `100 0101`**b** (`45`**h**) (`69`**d**)
   Least significant remaining 7 bits = `011 0111`**b** (`37`**h**) (`55`**d**)

4. The 7-bit fields are padded with a "1" in the most significant bit (MSB) position, thus creating two "data type" bytes. The byte containing the most significant bits of the sum (Cks1) is transmitted first, followed by Cks2 containing the least significant bits (LSB).
   `Cks1 = 1100 0101`**b** = `C5`**h** (`197`**d**)
   `Cks2 = 1011 0111`**b** = `B7`**h** (`183`**d**)

* where '**h**' is hexadecimal, '**d**' is decimal, and '**b**' is binary

End of Transmission

This is always the single character EOT (04 hex).

Host-Initiated Communications Protocol

Most of the information transfer activity is initiated by a Host system through a control port. For example, the Host can send Commands to the Matrix to request data from or send data to the Matrix 200. After receiving a command, the Matrix 200 executes it and sends back a Response to the Host. The Response includes an error code together with any requested data.

The Response includes the original Command code. Its format is as follows:

1. Command code — CMD byte (plus SCMD for some commands)
2. Error code — Erc (see list)
3. Data (if any)
4. Checksum — Cks
5. End of transmission mark — EOT

Error Codes (Erc)

The error code is usually bit-encoded and follows the data format (bit-7 always "1" to indicate a data byte). An error code of 80 (hex) indicates "no error". Other error codes specify the reason for not properly executing a command. The first error condition encountered will determine the error code. The following list has Erc codes that could occur in response to any command, and others that are associated with specific commands. (See command for description.)

Erc	description	Erc	description	Erc	description
80h	no error (normal)	81h	checksum error	82h	illegal command
90h	no I/O boards	91h	system mismatch	92h	security code error

Erc	see command	Erc	see command	Erc	see command
C0	CMD7	C1	CMD8	C2	CMD11
C3	CMD10	C4	CMD23	C5	CMD14
C6	CMD14	C7	CMD16	C8	CMD16
C9	CMD1	CA	CMD16	CB	CMD16
CC	CMD16	CD	CMD18	CE	CMD18
CF	CMD18	D0	CMD18	D1	CMD20
D2	CMD35	D3	CMD1	D4	CMD36/37

Matrix-Initiated Communications Protocol

Sometimes, under abnormal conditions, the Matrix 200 may detect a situation that must be reported to the Host. For example: Auxiliary power supply is activated, memory error, backup battery must be replaced, etc. These Matrix Reports are listed and explained later. They have the same general command format as the Host-initiated commands, but no response is expected from the host.

Timing

When Commands are sent to the Matrix 200 switcher, the response is delayed due to normal processing time. The response time has two components: RS-232/ RS-422 bus delay and Matrix 200 processing time. Matrix 200 processing time is variable, depending on the length of the command and the matrix size. Response time is usually less than 100 msec.

Command List (Host-to-Matrix)

Command	Hex	Page	Description
CMD0	30	B-8	request status (requires SCMD)
CMD1	31	B-9	request System ID information (requires SCMD)
CMD2	32	B-9	turn power ON
CMD3	33	B-10	turn power OFF
CMD4	34	B-10	request software version
CMD5	35	B-12	set (tie) single connection
CMD7	37	B-12	set (tie) all connections
CMD8	38	B-13	request status and presets
CMD9	39	B-13	mute all planes
CMD10	3A	B-13	save current as preset #
CMD11	3B	B-13	load preset #
CMD12	3C	B-14	mute selected outputs
CMD13[2]	3D	B-14	request Mute map
CMD14[2]	3E	B-14	create a sequence of presets and save it
CMD15[2]	3F	B-15	request stored sequence (saved presets)
CMD16[2]	40	B-15	operate sequence (start/stop/resume/delete/ copy)
CMD17[2]	41	B-15	request a list of all saved presets
CMD18[2]	42	B-16	set program to start on time & date
CMD19[2]	43	B-16	request program that has been setup
CMD20[2]	44	B-16	operate program (delete)
CMD22	46	B-16	set the clock
CMD23	47	B-17	request the clock information
CMD24	48	B-17	set Executive mode
CMD25	49	B-17	set RGB delay (after sync, for clean switching)
CMD26	4A	B-17	request RGB delay setting
CMD27	4B	B-18	set baud rate for host controller
CMD28	4C	B-18	request the baud rate for a port
CMD29	4D	B-18	set operating mode (vertical switching, slave, etc.)
CMD31[2]	4F	B-19	set slave mode with specified coordinates
CMD32[2]	50	B-19	request slave coordinates
CMD33	51	B-19	identify port
CMD34	52	B-19	set security password
CMD35	53	B-20	security operations (requires SCMD)
CMD36	54	B-20	set audio parameters (requires SCMD)
CMD37	55	B-22	request audio parameters (requires SCMD)

[2] Not supported by Matrix 200, version 1.0 software.

SCMD = Subcommand, a second byte that further defines the Command. See page B-5.

Reports (Matrix-to-Host)

RPRT0	70	B-23	report status to host
RPRT1	71	B-23	report controlling port

Communication Control

CR	0D		carriage return
EOT	04		end of transmission
X-On	11		resume transmission
X-Off	13		interrupt transmission

Using Commands

The remainder of this appendix explains the operation of each command including data byte breakdown, responses and possible error codes.

CMD0 (30h) — Send Status

The Host asks the Matrix for its status settings.

Format: CMD0, SCMD, Cks1, Cks2, EOT

Where: SCMD = 080h send status bytes
81h-8Fh reserved

Response: SCMD = 080h — send status bytes

Format: 30h, 80h, Erc, StsB1, StsB2, StsB3, Cks1, Cks2, EOT
Status Bytes (StsB1-3) are described below.

Status Byte 1:	7	6	5	4	3	2	1	0
Bit usage:	1	Prg	Seq	Slv	Ver	Gnlk	Batt	Pwr

Where: StsB1, Bit 0 Power On/Off status — 0 = powered on; 1 = powered off
StsB1, Bit 1 Backup battery status — 0 = battery okay; 1 = battery low
StsB1, Bit 2 Genlock Signal — 0 = detected; 1 = not detected
StsB1, Bit 3 Vertical interval switching — 0 = disabled; 1 = enabled
StsB1, Bit 4 Slave status — 0 = stand alone unit or master controller 1 = slave in a compound matrix
StsB1, Bit 5 Sequence running — 0 = not running; 1 = running
StsB1, Bit 6 Program status — 0 = no program event pending; 1 = program event pending (timer is set)

Status Byte 2:	7	6	5	4	3	2	1	0
Bit usage:	1	0	0	0	Cksm	H-Sec	Exec	Ps

Where: StsB2, Bit 0 Power Supply in use — 0 = Backup Power; 1 = Main Power
StsB2, Bit 1 Executive mode status — 0 = Executive mode Off; 1 = Executive mode On
StsB2, Bit 2 Hardware Security status — 0 = locked; 1 = unlocked (available to user, when unlocked)
StsB2, Bit 3 Checksum status — 0 = Checksum enabled 1 = Checksum disabled
StsB2, Bits 4-6 are reserved (should be zero)

Status Byte 3:	7	6	5	4	3	2	1	0
Bit usage:	1	0	0	0	0	0	0	S-Sec

Where: StsB3, Bit 0 Software Security status — 0 = locked; 1 = unlocked (available to user, when unlocked)
StsB3, Bits 1 thru 6 are reserved (should be zero)

CMD1 (31h) — Report ID

The Host asks for the configuration of the Matrix. This includes information such as: what type of switching modules are installed in which planes, etc.

Format: CMD1, SCMD, Cks1, Cks2, EOT

Where: SCMD = 80h Reserved
81h Reserved
82h Report technology (See example)
83h Reserved

Example: SCMD = 82h Report Technology (See example at bottom of page.)

Response: CMD1, 82h, Erc, *{(BdAd, #Inp, #Out, Tech, CR), ...} Cks1, Cks2, EOT

Possible Ercs: D3 — No I/O boards detected.

**Note: The string of data bytes in parentheses is shown for one switcher or plane; there will be an additional string for each additional plane in the Matrix 200. They will be transmitted in the ascending order of their board addresses (plane #1 first).*

Where: BdAd = board (or plane) address (plane #1 = 80h, plane #2 = 81h, etc.)
#Inp = number of inputs on this plane
#Out = number of outputs on this plane
Tech = See table.

The Tech byte encodes the basic design characteristics for which the board in that position was designed.

Tech	Designed For	Features
80h	Hi Resolution RGB	250 MHz DC-coupled, no clamping
81h	Sync	TTL level
82h	Low Resolution Video	30 MHz (Composite video or S-Video)
83h	Medium-Res RGB	175 MHz
84h	Audio	Balanced, with volume control
FFh	Error	Mixed technologies (as in composed matrices)

An example response to a Report Technology command for a Matrix with 8 x 8 RGBS, 4 x 4 Composite Video and 8 x 8 Audio could be:

31, 82, 80, (CMD1, SCMD, Erc)

80, 88, 88, 80, 0D, 81, 88, 88, 80, 0D, 82, 88, 88, 80, 0D, (Red, Green, Blue)

83, 88, 88, 81, 0D, 84, 84, 84, 82, 0D, 85, 88, 88, 84, 0D, (Sync, C-video, Audio)

Cks1, Cks2, 04 (Checksum and End of Transmission)

CMD2 (32h) — Turn Power On

The Host tells the Matrix to turn power on.

Format: CMD2, Cks1, Cks2, EOT

Example: 32h, 80h, B2h, 04h

Response: CMD2, Erc, Cks1, Cks2, EOT

CMD3 (33h) — Turn Power Off

The Host tells the Matrix to turn power off. The action is independent of other active control ports, e.g., Front Panel Controller.

Format: CMD3, Cks1, Cks2, EOT

Example: 33h, 80h, B3h, 04h

Response: CMD3, Erc, Cks1, Cks2, EOT

CMD4 (34h) — Send Software Version

The Host asks the Matrix to send the current software version. The format is "x.y".

Format: CMD4, Cks1, Cks2, EOT

Example: 34h, 80h, B4h, 04h

Response: CMD4, Erc, SfVer, Cks1, Cks2, EOT

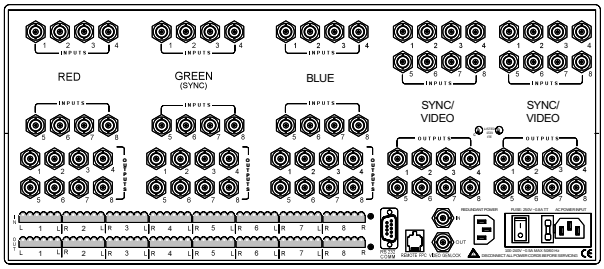
Example: Assuming software version is 1.3 (x=1, y=3)
To determine the SfVer from x.y:
1. calculate 10x + y (decimal) (10x1 + 3 = 13d)
2. convert to hex (13d = Dh)
3. force bit 7 to become 8Dh

Response: 34h, 80h, 8Dh, Cks1, Cks2, 04h

Set (Tie) Connection Commands

The Set Connection Commands that follow are the programming equivalent of the **Tie Menus** used from the FPC. Tie menus are described in Chapter 4.

Planes and Plane Maps



When looking at the rear panel of the Matrix 200, the planes are counted from left-to-right, top-to-bottom. Presently, six planes (switching modules) are supported with hardware. Planes 1, 2, and 3 are reserved for Red, Green, and Blue modules. Planes 4 and 5 can have either sync or video switching modules, depending on how the Matrix 200 was configured at the factory. A Matrix, built with both a sync and composite video switcher, will have the sync module in plane 4 and the composite video module in plane 5. Plane 6 is reserved for stereo audio.

The Matrix 200 can access the planes independently, or in combinations, or in groups. Commands can access the planes by using Plane Map bytes called PlnMap0 and PlnMap1. (PlnMap1 is not used at this time.)

Examples below show the correlation between the planes and the bit numbers.

PlnMap0 to access the RGBS Switcher (planes 1, 2, 3 & 4)

Plane #	n/a	7	6	5	4	3	2	1
Plane Use	n/a	n/u	Audio Stereo	Sync/ Video	Sync/ Video	Blue hi-res	Green hi-res	Red hi-res
PlnMap Bit #	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
8F hex	1	0	0	0	1	1	1	1

PlnMap0 to access the Composite Video Switcher (plane 5)

Plane #	n/a	7	6	5	4	3	2	1
Plane Use	n/a	n/u	Audio Stereo	Sync/ Video	Sync/ Video	Blue hi-res	Green hi-res	Red hi-res
PlnMap Bit #	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
90 hex	1	0	0	1	0	0	0	0

PlnMap0 to access the Audio Switcher (plane 6)

Plane #	n/a	7	6	5	4	3	2	1
Plane Use	n/a	n/u	Audio Stereo	Sync/ Video	Sync/ Video	Blue hi-res	Green hi-res	Red hi-res
PlnMap Bit #	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
A0 hex	1	0	1	0	0	0	0	0

The plane number refers to the physical address of the I/O module.

CMD5 (35h) — Set (Tie) Connection

The Host tells the Matrix to connect the specified output (Out#) to the specified input (Inp#) in those planes specified by PlnMap0. (Plane maps are explained earlier in this section.)

Format: CMD5, PlnMap1, PlnMap0, Out#, Inp#, Cks1, Cks2, EOT

Example: 35h, 80h, 87h, 83h, 85h, Cks1, Cks2, 04h
This example will connect output #3 to input #5 in RGB planes.
PlnMap1 is not used at this time, therefore it will be 80h.
PlnMap0 = 87h (bits 0, 1 & 2 = 1, 1, 1 for the Red, Green and Blue planes) See Plane Map on previous page.
Out# = 83h = Output #3
Inp# = 85h = Input #5

Response: CMD5, Erc, Cks1, Cks2, EOT

CMD7 (37h) — Set (Tie) All Connections

The Host tells the Matrix to set connections for any (or all) planes in the Matrix. The planes must be specified by board address (BdAd) in sequential order. A preset number is assigned for saving this configuration. The configuration may be loaded later by selecting the preset number.

Format: CMD7, Preset, {(BdAd, Inp1, Inp2, ... Inp*n*, CR), ...}, Cks1, Cks2, EOT

Example: 37h, 82h, **80h**, 83h, 83h, 85h, 80h, 80h, 80h, 81h, 81h, 0Dh, **81h**... Cks1, Cks2, 04h

Where:

A) **Preset** is the number assigned to this configuration (the example uses preset #2).
Preset numbers can be 1 - 20 (81h - 94h). If the information is to be used as the current Matrix configuration without saving it as a preset, the number for this will be zero (80h).

B) (BdAd, Inp1, Inp2, ... Inp*n*, CR) is a string of bytes for each plane record, with the following components:

a. BdAd is the board address for the plane (example is 80h = red plane).
b. Inp1 is the input # to connect to output #1. (example ties input #3)
Inp2 is the input # to connect to output #2. (example ties input #3)
c. Inp*n* is the input# to connect to the last output. (example ties output #8 to input #1)
d. CR — carriage return (0Dh) terminates the data string for this plane.

C) Another plane record (data string) will follow for the next plane to be configured — and another, etc. for each plane to be configured.

1. The plane record has a length determined by the number of outputs (n).
2. Only existing planes are valid.
3. Any, or all, valid planes may be specified in the same command.
4. Planes must be specified in ascending BdAd address order. (Plane 1 first; plane n last.)

Response: CMD7, Erc, Cks1, Cks2, EOT

Possible Ercs: C0 = Out of memory space

CMD8 (38h) — Download Status and Presets

The Host asks the Matrix 200 to send the contents of the specified preset. Same variables are used as in CMD7. (Stored presets are numbered 1 thru 20, however, the current Matrix setup can be accessed as preset “0”.)

Format: CMD8, Preset, Cks1, Cks2, EOT

Response: CMD8, Erc, {(BdAd, Inp1, Inp2, ...Inp*n*, CR), ...}, Cks1, Cks2, EOT

Possible Ercs: C1 = Preset file not found

Where: Preset can be 80h (current configuration) or 81h (1) thru 94h (20). As described in CMD7, there is a data string for each plane starting with its board address (BdAd) and ending with 0Dh (carriage return).

CMD9 (39h) — Mute All Planes

The Host instructs the Matrix to mute (deactivate) all outputs in specified planes.

Format: CMD9, PlnMap1, PlnMap0, Cks1, Cks2, EOT

Where: PlnMap1 and PlnMap0 follow the format described for CMD1. Bits are “0” for normal operation and “1” to mute the plane.

Example: If PlnMap1, PlnMap0 = 80h, 83h. Red and Green channels are muted. All RGB displays connected to Matrix 200 outputs will show only the blue component of the signal.

At this time, only PlnMap0 is supported by hardware. PlnMap1 = 80h. Bits for nonexisting planes are forced to 0.

CMD10 (3Ah) — Save Current as Preset

The Host tells the unit to save its current connections as a preset. (The preset can be called later using CMD11.)

Format: CMD10, Preset, Cks1, Cks2, EOT

Where: Preset can be 81h (1) thru 94h (20).

Response: CMD10, Erc, Cks1, Cks2, EOT

Possible Ercs: C3 = Out of memory space

CMD11 (3Bh) — Load Preset

The Host tells the Matrix to load (activate) a stored preset configuration. The connections previously stored under the specified preset number become active. The current connections are lost, unless they have also been saved as a preset.

Format: CMD11, Preset, Cks1, Cks2, EOT

Response: CMD11, Erc, Cks1, Cks2, EOT

Possible Ercs: C2 = Preset file not found

CMD12 (3Ch) — Mute Selected Outputs

The Host tells the Matrix to mute specific planes within selected outputs.

Format: CMD12, Mute1, Mute2, ... Mute*n*, Cks1, Cks2, EOT

Where: MuteX specifies planes to be muted for the output corresponding to the mute byte number. This uses the same format as PlnMap shown below.

PlnMap0 to access the RGBS Switcher (planes 1, 2, 3 & 4)

Plane #	n/a	7	6	5	4	3	2	1
Plane Use	n/a	n/u	Audio Stereo	Sync/ Video	Sync/ Video	Blue HRAM	Green HRAM	Red HRAM
PlnMap Bit #	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
MuteX	1	0	x	x	x	x	x	x

HRAM = High Resolution Analog Module.

Example: Assume an 8 x 8 switcher, with RGBS, Composite video and Audio.
3Ch, 87h, A0h, 90h, 97h, 80h, 80h, 80h, 80h, Cks1, Cks2, 04h

The following outputs are muted:

87h	Output 1:	R, G, B (leave sync on)
A0h	Output 2:	Audio Stereo (Left + Right)
90h	Output 3:	Composite video
97h	Output 4:	R, G, B and Composite video
80h	Outputs 5 - 8:	Outputs not muted

Response: CMD12, Erc, Cks1, Cks2, EOT

CMD13 (3Dh) — Request Mute Map

The Host asks the Matrix to send which outputs are muted. The response sends back the same data in the same format as CMD12.

Format: CMD13, Cks1, Cks2, EOT

Example: 3Dh, 80h, BDh, 04h

Response: CMD13, Erc, Mute1, Mute2, ... Mute*n*, Cks1, Cks2, EOT

Where: MuteX specifies planes to be muted for the output corresponding to the mute byte number. This uses the same format as PlnMap shown above.

CMD14 (3Eh) — Set Sequence

The Host tells the Matrix 200 to create a Sequence of presets and store it under a specified Sequence number. The command also specifies how long each preset will run (be active).

Format: CMD14, Seq#, {(PSet#, Hr, Min, Sec, CR), ..} Cks1, Cks2, EOT

Where: SEQ# Sequence number (1 to 31).
(PSET#, Hr, Min, Sec, CR) repeat this string for each Preset that will be part of the Sequence. Each Preset string will become a sequence “step”.

PSet#	Preset number (1 to 20)
Hr	Number of hours to run (0 to 17)
Min	Number of minutes to run (0 to 59)
Sec	Number of seconds to run (0 to 59)

Notes: 1. Maximum number of sequences is 31.

2. Maximum number of steps in any sequence is 31.
3. Total number of steps for all sequences is 128.
4. It is recommended that all sequences be listed and named, for future reference.
(e. g. Sequence #4 is XYZ Presentation; Sequence #1 is Product Demo; etc.)

See decimal/binary/hex conversion table on page B-2.

Response: CMD14, Erc, Cks1, Cks2, EOT

Possible Ercs: C5 = Out of memory space;

C6 = Not enough space for next sequence step (sequence incomplete)

CMD15 (3Fh) — Request a Stored Sequence

The Host asks the Matrix to send the information contained in a specific Sequence. This would have the same format as shown for CMD14. This command could be used to edit a sequence and save it again, or to edit and save it as a new Sequence.

Format: CMD15, Seq#, Cks1, Cks2, EOT

Response: CMD15, Erc, Seq#, {see CMD14}, Cks1, Cks2, EOT

CMD16 (40h) — Operate Sequence

The Host tells the Matrix to perform a specified operation regarding previously stored sequences. See SqOp list below.

Format: CMD16, SqOp., Seq#, Cks1, Cks2, EOT

Where: Seq# Sequence number to be operated on (bits 4-0)
Sequence 1 - 31 = 81h - 9Fh)
and: SqOp Operation code as follows:

80h	Start a specific sequence (SEQ#)
81h*	Stop (interrupt) sequence that is now running.
82h*	Resume running the sequence that was stopped.
83h	Delete a specific sequence (SEQ#)
E0-FFh	Copy Seq# to the sequence # defined by bits 4-0.

* Set Seq# to 80h

Response: CMD16, Erc, Cks1, Cks2, EOT

Possible Ercs: C7, C8, C9, CA, CB = sequence not found (depending on SqOp)
CC = Out of memory space

CMD17 (41h) — Request a List of Presets

The Host asks the Matrix to send a list of all defined presets.

Format: CMD17, Cks1, Cks2, EOT

Example: 41h, 80h, C1h, 04h

Response: CMD17, Erc, (PresetX, ...PresetY, CR), Cks1, Cks2, EOT

Where: **Preset** is the number of a saved preset. All saved preset numbers will be sent in numeric order. (Preset #1 = 81h) If no presets are stored, this byte will be 80h.

CMD18 (42h) — Set Program

The Host tells the Matrix to start a specific event (preset or sequence) at a specific time, on a specific date. Matrix power will be turned On at that time. This is called a program. Only one program can exist in a Matrix 200 at one time.

Format: CMD18, PrgEvnt, Num, Yr, Mo, Dy, Hr, Min, Sec, Cks1, Cks2, EOT

Where: PrgEvnt the program event which will be started (triggered).
80h a Preset will be started
81h a Sequence will be started
Num the event (preset or sequence) number to be started.
(for Yr, Mo, Dy, Hr, Min, Sec see clock - CMD22)

Response: CMD18, Erc, Cks1, Cks2, EOT

Possible Ercs: CD = Clock not set
CE = Sequence file not found
CF = Preset file not found
D0 = Too late; run time has passed

CMD19 (43h) — Request the Current Program

The Host requests the characteristics of the pending program. There can only be one program in the Matrix at one time, therefore, no specific information is needed.

Format: CMD19, Cks1, Cks2, EOT

Example: 43h, 80h, C3h, 04h

Response: CMD19, Erc, PrgEvnt, Num, Yr, Mo, Dy, Hr, Min, Sec, Cks1, Cks2, EOT

CMD20 (44h) — Operate Program

The Host specifies action directed to programs.

Format: CMD20, PrgOp, PrgEvnt, Num, Cks1, Cks2, EOT

Where: PrgOp Specifies the action to be executed.
80h Delete the program
81-FFh reserved, PrgEvnt and Num are not currently used.

Response: CMD20, Erc, Cks1, Cks2, EOT

Possible Ercs: D1 = No program found

CMD22 (46h) — Set Clock

The Host sends the date and time for the Matrix 200 to set the internal calendar and clock.

Format: CMD22, Yr, Mo, Day, Hr, Min, Sec, Cks1, Cks2, EOT

Range:	Yr	00-99	Mo	01-12
	Day	01-31	Hr	00-23
	Min	00-59	Sec	00-59

Response: CMD22, Erc, Cks1, Cks2, EOT

CMD23 (47h) — Request the Clock Information

The Host asks the Matrix for its clock settings.

See decimal/binary/hex conversion table on page B-2.

Format: CMD23, Cks1, Cks2, EOT

Example: 47h, 80h, C7h, 04h

Response: CMD23, Erc, Yr, Mo, Day, Hr, Min, Sec, Cks1, Cks2, EOT

Possible Ercs: C4 = Clock not set

CMD24 (48h) — Turn Executive Mode On/Off

The Host requests the Matrix to turn Executive Mode on/off.

Format: CMD24, Mode, Cks1, Cks2, EOT

Where: Mode = 80h turn Executive mode On
81h turn Executive mode Off

Example 1: 48h, 80h, 81h, C8h, 04h

Response: CMD24, Erc, Cks1, Cks2, EOT

Example 2: 48h, 81h, 81h, C9h, 04h

Response: CMD24, Erc, Cks1, Cks2, EOT

CMD25 (49h) — Set RGB Delay

The Matrix is instructed to set values for RGB delay. When switching occurs, the R, G and B switching will take place after the specified time delay. The sync switching takes place immediately, but the RGB outputs are muted during this delay period. This allows the projector to get in sync before the picture arrives, providing seamless switching.

Format: CMD25, Dly1, Dly2, ... Dly*n*, Cks1, Cks2, EOT

Where: Bits 0-6 of DlyX represent the RGB-to-sync delay for output X (expressed in increments of 0.1 sec). The "*n*" represents the number of outputs as determined by command CMD1. (Dly1 = output #1; Dly2 = output #2, etc.)

Delays must be specified for each output. For zero time delay, DLY = 80h. The time delay depends on the requirements of the output device (projector, etc.).

Example: 49h, 84h, 90h, etc. says the RGB for output #1 will be delayed by 0.4 seconds, and output #2 will be delayed by 1.6 seconds, etc.

Response: CMD25, Erc, Cks1, Cks2, EOT

CMD26 (4Ah) — Request RGB Delay Information

The Host asks the Matrix to send delay switching information for the RGB planes.

Format: CMD26, Cks1, Cks2, EOT

Example: 4Ah, 80h, CAh, 04h

Response: CMD26, Erc, Dly1, Dly2, ... Dly*n*, Cks1, Cks2, EOT

Where: DlyX characters have the same significance as in previous command.

CMD27 (4Bh) — Set Baud Rate

Sets the baud rate for the host controller. Front panel baud rate cannot be set using this command. When the port is changing its own baud rate, this becomes active only after the response has been sent back.

Format: CMD27, Port#, Rate, Cks1, Cks2, EOT

Where: Port# = 80h host controller
81h n/a
82-FFh reserved

Bits 3-0 of Rate byte encode the baud rate:

80h	300 baud
81h	600 baud
82h	1200 baud
83h	2400 baud
84h	4800 baud
85h	9600 baud
86h	19,200 baud
87h	38,400 baud
88-8Fh	reserved

Bits 6-4 = 0 for No Parity
Bits 6-4 = 1-7 reserved

Response: CMD27, Erc, Cks1, Cks2, EOT

CMD28 (4Ch) — Download Baud Rate

The Host asks the Matrix 200 to send the baud rate of a specific port.

Format: CMD28, Port#, Cks1, Cks2, EOT

Response: CMD28, Erc, Rate, Cks1, Cks2, EOT

Where: Rate and Port# have the same format as in CMD27

CMD29 (4Dh) — Set Operating Mode

The Host tells the Matrix 200 to enter a specific operating mode.

Format: CMD29, Mode, Cks1, Cks2, EOT

StsB1 is Status Byte #1, described on page B-8, for command CMD0.

Where: Mode = 80h enable vertical interval switching, set bit-3 of StsB1
81h disable vertical interval switching, clear bit-3 of StsB1
82h enter a slave mode, set bit-4 of StsB1
83h enter an independent mode, clear bit-4 of StsB1
84h-FFh reserved

Response: CMD29, Erc, Cks1, Cks2, EOT

Vertical interval switching implies using the Genlock signal from the "Genlock In" connector on the back of the Matrix.
If vertical interval switching is enabled and there is no Genlock signal, switching takes place after 50 ms.

CMD31 (4Fh) — Set Slave Coordinates

Reserved for future use.

Format: CMD31, CDOut, CDIn, Cks1, Cks2, EOT

Example: CDOut, CDIn = 89h, 91h.

Where: CDOut and CDIn specify where the slave matrix is mapped into the compound matrix space, (see also CMD1).

If the Matrix 200 is in a slave mode, its output #1 functions as output #9 of the compound matrix while input #1 becomes input #17 (decimal).

Response: CMD31, Erc, Cks1, Cks2, EOT

CMD32 (50h) — Request Slave Coordinates

Reserved for future use.

Format: CMD32, Cks1, Cks2, EOT

Example: 50h, 80h, ... 04h

Response: CMD32, Erc, CDOut, CDIn, Cks1, Cks2, EOT

CMD33 (51h) — Identify Port

Unit is requested to specify at which port this command was received. This is intended primarily for front panels to determine at which port they are connected.

Format: CMD33, Cks1, Cks2, EOT

Example: 51h, 80h, ... 04h

Response: CMD33, Erc, Port#, Cks1, Cks2, EOT

Where: Port (as below)

80h	host controller (RS-232)
81h	n/a
82h	standard front panel controller (FPC)
83h	secondary front panel controller (FPC)

CMD34 (52h) — Set Security Passcode

Sets security passcode. When security is in effect, at the beginning of a session the user must enter a password code that matches the one specified by this command.

Format: CMD34, MPas1, MPas2, Cks1, Cks2, EOT

Where: MPas1 and MPas2 define a 4-digit decimal number (80h thru E3h).

Response: CMD34, Erc, Port#, Cks1, Cks2, EOT

MPasn - The 2-hex digits translate to 4-digit decimal.
Security code 80h = 00dec and E3 = 99dec. See conversion table on page B-2.

CMD35 (53h) — Operate Security

The Host sends information to modify the status of the security system. The command has the following subcommands:

Where: SCMD = 80h Request system access (format 1)
81h Terminate session and lock system (format 2)
82-FFh reserved

Format 1: CMD35, 80h, UPas1, UPas2, Cks1, Cks2, EOT

Where: UPas1 and UPas2 are user-entered security codes that must match internally stored MPas1 and MPas2 to gain access to the system. If they match, the security status bit (StsB3, bit-0) will be set accepting all subsequent commands.

UPASn - The 2-hex digits translate to 4-digit decimal.
Security code 80h = 00dec and E3 = 99dec. See conversion table on page B-2.

Response : CMD35, 80h, Erc, Cks1, Cks2, EOT

Possible Ercs: D2 = No passcode assigned

Format 2: CMD35, 81h, Cks1, Cks2, EOT
Terminate the session and lock the system.

There is only one security code for all existing ports. All ports have equal access to the security system, so a conflict may arise whenever more than one port is active.

CMD36 (54h) — Set Audio Parameters

The host tells the Matrix how to set all eight inputs or outputs of the audio board performance features, such as gain/attenuation and channel configuration. The command must include data for all eight inputs or outputs. The first data string is for I/O #1, the second for I/O #2, etc.

Format: CMD36, SCMD, {(LGain, RGain, Misc, CR)...}, Cks1, Cks2, EOT

Where: SCMD bits 3-0 = BdAd (board address, or plane #)
bits 7-4 = 8h (1000b) for input settings (INP)
= 9h (1001b) configure output (OUT)
= Ah - Fh (1010 - 1111b) are reserved

Possible Ercs: D4 = No audio board

The first time power is applied to the audio board, the following conditions exist:
No inputs are connected to outputs.
All inputs are set for professional levels.
All outputs are set for consumer levels.

Examples follow.

Configure Audio Inputs

Case 1 — SCMD = 85h, configure input section of plane #5 (standard audio board address)

. Format: 54h, 85h, {(InLeftGain, InRightGain, InMisc, CR), ...}Cks1, Cks2, EOT

dB range:
hex dB
FFh +31
FEh +30
etc.
E0h 0dB
DFh -1
DEh -2
etc.
C1h -31
C0h -32
etc.
81h -95
See conversion table on page B-2.

Where: InLeftGain, bits 6 - 0 are the seven most significant bits of the left channel gain of the input circuit. (Range: 81h - FFh = -95dB to + 31dB)

InRightGain, bits 6 -0 are the seven most significant bits of the right channel gain of the input circuit. (Range: 81h - FFh = -95dB to +31dB)

InMisc, are the miscellaneous bits associated with the input circuit:
bit 0 = lsb (the 8th) of the left input gain (if 1, add 0.5 dB to InLeftGain)
bit 1 = lsb (the 8th) of the left input gain (if 1, add 0.5 dB to InRightGain)
bit 2 = 1 for standard/consumer signal input level (-10 dBu)
= 0 for professional input level (+4 dBu)
bits 6-3 are reserved; must be zero
bit 7 = always “1” (this is a data byte)

Example: 54h, 85h, EAh, EAh, 83h, 0Dh, ...Cks1, Cks2, 04h
Set left & right input #1 for +10.5dB at professional input level. A string follows for the remaining seven audio inputs.

Configure Audio Outputs

Case 2 — SCMD = 95h, configure output of plane #5 (standard audio board address).

Format: 54h, 95h, {(OutLeftGain, OutRightGain, OutMisc, CR) ...}

Where: OutLeftGain, bits 6-0 are not used; must be 80h.

OutRightGain, bits 6-0 are not used; must be 80h.

OutMisc are the miscellaneous bits associated with the output circuit:
bit 0 = reserved; must be zero.
bit 1 = reserved; must be zero.
bit 2 = 1 for standard/consumer signal input level (-10 dBu)
= 0 for professional input level (+4 dBu)
bits 4-3 connect the left and right stereo channels as follows:
00b = Pass thru (left-to-left, right-to-right)
01b = left channel to both left & right outputs
10b = right channel input to both left & right outputs
11b = swap: left input to right output; right input to left output.
bits 6-5 are reserved; must be zero.
bit 7 = always “1” (this is a data byte)

Example: 54h, 95h, 80h, 80h, 9Ch, 0Dh, ... Cks1, Cks2, 04h
Set output #1 for consumer signal and swap left & right channels. A data string must follow for each of the other seven outputs.

CMD37 (55h) — Request Audio Parameters

The Host asks the Matrix 200 to send the configuration for the audio board.

Format: CMD37, SCMD, Cks1, Cks2, EOT

Where: SCMD contains the board address. Same as CMD36.

Example 1: 55h, 85h, Cks1, Cks2, 04h
Requests input audio information for audio plane (board #5).

Example 2: 55h, 95h, Cks1, Cks2, 04h
Requests output audio information for audio plane (board #5).

Response: CMD37, 85, Erc, {(InLeft Gain, InRightGain, InMisc, CR)...}
or
CMD37, 95, Erc, {(OutLeft Gain, OutRightGain, OutMisc, CR)...}

Possible Ercs: D4 = No audio board

Reports (Matrix-to-Host)

Report0 (70h) — Status

This report is broadcast when a change in internal status is detected.

Format: RPRT0, StsB1, StsB2, StsB3, Cks1, Cks2, EOT

Status Byte 1:	7	6	5	4	3	2	1	0
Bit usage:	1	Prg	Seq	Slv	Ver	Gnlk	Batt	Pwr

Where:
- StsB1, Bit 0 — Power On/Off status — 0 = powered on; 1 = powered off
- StsB1, Bit 1 — Backup battery status — 0 = battery okay; 1 = battery low
- StsB1, Bit 2 — Genlock Signal — 0 = detected; 1 = not detected
- StsB1, Bit 3 — Vertical interval switching — 0 = disabled; 1 = enabled
- StsB, 1 Bit 4 — Slave status — 0 = stand alone unit or master controller; 1 = slave in a compound matrix
- StsB1, Bit 5 — Sequence running — 0 = not running; 1 = running
- StsB1, Bit 6 — Program status — 0 = no program event pending; 1 = program event pending (timer is set)

Status Byte 2:	7	6	5	4	3	2	1	0
Bit usage:	1	0	0	0	Cksm	H-Sec	Exec	Ps

Where:
- StsB2, Bit 0 — Power Supply in use — 0 = Backup Power; 1 = Main Power
- StsB2, Bit 1 — Executive mode status — 0 = Executive mode Off; 1 = Executive mode On
- StsB2, Bit 2 — Hardware Security status — 0 = locked; 1 = unlocked (available to user, when unlocked)
- StsB2, Bit 3 — Checksum status — 0 = Checksum enabled; 1 = Checksum disabled

StsB2, Bits 4-6 are reserved (should be zero)

Status Byte 3:	7	6	5	4	3	2	1	0
Bit usage:	1	0	0	0	0	0	0	S-Sec

Where:
- StsB3, Bit 0 — Software Security status — 0 = locked; 1 = unlocked (available to user, when unlocked)

StsB3, Bits 1 thru 6 are reserved (should be zero)

Report1 (71h) — New Controlling Port

This report is broadcast when a change in the connections (current or presets) or the operating mode is requested (and implemented) by a new port. Commands 5, 7, 9, 11, 12, 14, 18, 25, 27, and 29 will cause this report to be broadcast.

Format: RPRT1, Port#, Cks1, Cks2, EOT

Where: Port# as follows ...

80h	host controller (RS-232)
81h	n/a
82h	standard front panel controller port
83h	secondary front panel controller port

This concludes the programming section.